OCT 20 1886

THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XLV.—No. 6. Whole No. 654. | NEW YORK, THURSDAY, SEPTEMBER 16, 1886. | $3 PER ANNUM IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. JOS. R. THOMAS, C.E., Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Published on the 2d and 16th of each month, at No. 42 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $3.50 (15 shillings—18 francs). All payments to be made in advance. Single copies, 15 cents.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—

The Fourteenth Annual Meeting of the American Gas Light Association..... 163

EDITORIALS—

Hold Them to Their Contract Obligations..... 164

The Relative Calorific Effects of Tar (with and without steam) and Coke for Retort Firing, by F. G. Dexter..... 165

*The Economical Construction of Gasholders and Tanks, by Mr. Jno. Somerville..... 166

Prof. Orton, on the Gas and Oil Fields of Northern Ohio..... 169

A Well Attended Exhibition..... 170

Special English Correspondence..... 171

Those Beastly Paraffin Lamps—The Effect of Burning Tar in the Retort House on the Finances of the South Metropolitan Gas Company—The Gas Light and Coke Company and Tar Burning—Electricity and Gas—The Avery Gas.

Notes from the West, by Retort..... 172

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 172

Personal—Annual Meeting, Providence (R. I.) Gas Company—A Line or Two from Hudson, N. Y.—And Still the Work Goes on—Cheaper Gas for Taunton, Mass.—Not to Make Gas—The Butte City (Montana) Gas Works—Cheaper Gas for Rome, Ga.—An Item from Barnesville, Ohio—New Gas Company—The Root Exhausters are in Great Favor—A Word or Two Concerning another St. Paul (Minn.) Gas Man—To Aid Commerce—Killed by Electricity—The Charleston (S. C.) Disaster—A Later Dispatch from Retort—Davis & Farnum will Not Stop—A Line or Two from Danville, Ills.—The American Gas Improvement Company—A Waif from Toronto, Canada—Cost of Street Lighting at Seattle, Wash. Ter.—No Electric Lights for Paupers—Acquiring More Property—A Royal Time—Comparative Value of Gas and Oil for Street Lighting.

CORRESPONDENCE—

Mr. Lansden, and not the JOURNAL, Can best Answer for the Results Secured at the St. Louis (Mo.) Gas Works..... 175

The Market for Gas Securities..... 176

[OFFICIAL NOTICE.]

The Fourteenth Annual Meeting of the American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION, September 10, 1886.

To the Members of the Association:—As already announced, the Fourteenth Annual Meeting of our Association will be held in the city of Philadelphia, Pa., on Wednesday, Thursday, and Friday, October 20th, 21st, and 22d. The meetings will be held at the *foyer* of the Academy of Music. The Convention will be called to order by the President, A. C. Wood, Esq., of Syracuse, N. Y., on Wednesday morning, the 20th proximo, at 10 o'clock. The headquarters of the Association will be at Hotel Lafayette, corner Broad and Chestnut streets, while the banquet will take place at the dining hall of the Union League Club. These selections are most happy ones, and assure us most congenial surroundings during our stay in Philadelphia. The hotel is about three minutes' walk from the depot of the Pennsylvania Railroad, and the Academy of Music is adjacent to the hotel. The hotel is run on both the American and European plans.

It is to be regretted that the members who have promised to provide papers for the meeting have been so backward in sending in the titles of their essays; however, I am able to announce the following papers now, and hope to add to the list shortly:

"Gas Commissions," by Geo. G. Ramsdell, of Vincennes, Ind. "A New Departure in Gas Holder Houses," by Captain Wm. Henry White, of New York. "Three-Hour Charges," by A. B. Slater, of Providence, R. I. "Condensation," by Robt. B. Taber, of New Bedford, Mass. "Statistics Regarding the Gas Companies of America," by Wm. W. Goodwin, of Philadelphia. "Suggestions upon Candle Power and Illumination," by A. E. Boardman, of Macon, Georgia.

This list, to say the least, is promising, for though short it includes many interesting themes. There has long been a feeling abroad that the National Association should speak, and in no uncertain voice, on the important question of the day—the establishment of Gas Commissions; it is well, therefore, that the question should be brought up at this time, so that it may be clear to all just where the Association stands in this matter.

In these days of sharp competition it is very necessary that the erection of new gas works, and the extension of old ones, should be carried out in conformity with the most modern thoughts in gas engineering, and it is equally imperative that the work should be done at the minimum cost consistent with substantial work, so that the charge for dividend may be kept down to the lowest point; if, therefore, our friend Capt. White can show us how to save money in the construction of a holder-house, the information will be most welcome, at least to those members of the fraternity who believe in the wisdom of protecting gas holders from the snow and gales of winter.

There was a time when it was thought necessary to consume six hours in burning off a charge of coal, but more recently it has been thought that four hours are all sufficient for this purpose; and so, in this country at least, four-hour charges have become the rule. There are, however, exceptions to all rules; and, therefore, we are not surprised at finding this rule disregarded in at least one instance. It is now well known that at Providence, R. I., the coal is baked off in three hours; and the Association will doubtless be very glad to know the ins and outs of this innovation.

If there is any one branch of the gas business upon which we need additional light more than another it is the condensation of gas. The paper promised by Mr. Taber will, therefore, be looked forward to with more than ordinary interest.

The statistics in our possession regarding the gas business, or the gas companies of this country, are so meagre that we must gladly welcome any additions to our scanty store. The facts promised by Mr. Goodwin will doubtless form a valuable addition to the literary part of the programme of the forthcoming meeting.

That the lighting effect of substances is not always in proportion to the candle power is a contention that may well be advanced, with some show of reason; however, we would not run the risk of forestalling what Mr. Boardman has to say on this theme, but will await with pleasure the reading of the author's views.

The value of the Fourteenth Annual Meeting of our Association will be greatly enhanced if the members will think over the various subjects sug-

gested by this list of papers between the present time and our convening at Philadelphia, and come prepared to take active parts in the discussion of these various topics.

As previously announced, if members have any special subjects which they desire to have discussed at the coming meeting, or have any questions in mind upon which they desire light, if they will send notice of the same to the Secretary an effort will be made to have the subjects considered.

Respectfully, C. J. R. Humphreys, Sec'y.

HOLD THEM TO THEIR CONTRACT OBLIGATIONS.

Within the last few years a most wonderful change seems to have taken place in the conditions and practices that formerly obtained in the commercial spirit which permeated and controlled the average sample of our man of business. Contracts, the faithful carrying out of which may properly be claimed to constitute the keystone of the commercial arch, are no longer to be regarded as honest pledges of faith between parties for the fulfillment of set ends; and it is truly regrettable that such a discomforting admission must be made. In fact the boasted enlightenment of our day, and the praises of which are loudly but not altogether concordantly sung by existing enthusiastic choristers, seems to have resulted in making us into a nation of lawyers—and very poor ones at that, when the field, as a whole, is even carelessly scanned. Time was when a man's word was as good as his bond, but the "bond" is not now at all seasons to be looked upon as a sterling document, for, as before intimated, every individual seems anxious to reveal the number of fathoms which he can pay out in the guise of legal cable lore. Perhaps we may yet remain satisfied over the portion of commercial integrity which still adheres to the skirts of our men of business, for, no matter what the latter have yet to do in the way of cutting completely adrift from the simple commercial principles of their forefathers, there are others who make no pretence of anything that savors of fairness in regard to the carrying out of contract obligations. Where, indeed, shall we look for purity in the stream if the source is polluted; and if the lawmaking power be smirched, or is reckless of carrying out, to the letter and spirit, its pledges and agreements, perhaps excuse may be offered for the layman who follows suit. Some of our readers may believe that this is a rather bilious way in which to discuss "contract obligations," but a great many of them must nevertheless concede that the picture contains no undue quantity of dark shading, since goodly numbers of the fraternity have experienced the effects which followed upon their dealings with lawmakers, and, more particularly, with city or village rulers—the latter gentry undoubtedly being the most erratic and inclined to promise that which they do not intend to perform. Given, a locality that a decade or more ago could boast of neither numbers nor wealth, but which if rightly developed was likely in time to become possessed of both, the first efforts of its founders would naturally be directed to making the place attractive, so that those who visited it might be induced to remain. In time the site prospered, and with its growing spirit a gas and water supply was demanded. Those already on the ground, from one or many causes, did not care to take the entire responsibility upon their shoulders—nor to go down into their pockets for the purpose of making the responsibility a fact—and invited capital from other quarters to take them out of their perplexity. In answer to the call capital looked over the situation, and its owners said, "If you will pledge to do so and so for a certain number of years we will do thus and so." The propositions were duly examined, and nothing improper or unfair was found in them, consequently they were accepted, and capital, of course, performed its allotted task in due season. The erstwhile town goes steadily on its way upward and onward, and a thriving, bustling city appears in place of the weakling of other times. Capital has never faltered in its duty—in fact it has done much more than it promised, and has taken no mean share in the advancement of local prosperity. Many streets have been lengthened out into districts as yet unoccupied, but the gas mains are extended into unprofitable territory so that the city might have no dark places, and so on. Now, however, a change comes over the local rulers, and murmurs about monopolies and monopolists are heard. The murmurs grow especially violent in the sacred vicinity of the haunts of the councilmen, and the inevitable end is the fracture of the city's plighted faith, given at an hour when the town of other days begged for help. The above will serve to give point to that which follows, and we must say that the examples now to be cited are exceptionally glaring cases of municipal dishonesty. In 1868 the City Council, of Saginaw, Michigan, granted to the incorporators of the Saginaw Gas Light Company an exclusive franchise to light the streets for a period of 30 years from the passage of the ordinance. In the company's charter, it is explained that gas was the article of commerce which its incorporators proposed to vend; but the understanding had was that the company was to *light* the city's streets for a *period of thirty years*, proper penalty being provided in case it failed in the performance of its contract obligations thus assumed. In consideration of this the works were erected, and no objection was offered to the style in which the duty imposed was carried out, until a short while ago, when the municipal authorities proposed to hand the street lighting of the city over to the Fort Wayne Jenney Electric Light Company. The owners of the gas works, through counsel, appeared before Judge Brown, sitting in U. S. Circuit Court for the district, on date of Aug. 31st, and asked that a writ of injunction be issued which would restrain the authorities from completing the proposed breach of faith. Messrs. Wheeler and McKnight, counsel for petitioners, presented a very strong argument in favor of the relief sought, and, without making any appeal on other than legal grounds, strongly fortified their position by quoting from the opinion rendered by the German courts in the matter of the celebrated Munich street lighting case, the features of which closely resembled those under discussion at Saginaw. In the Munich instance the courts held, "There has been an effort made to lay weight on the point that only the lighting of the streets with gas was conceded to the company, and that this did not hinder the introduction of electric lighting, since this could take place without violating the provisions of the charter. This interpretation is entirely contrary to good faith, because the city has bound itself to have its streets lighted by gas for 36 years, and must do this in fulfillment of its contract, since a contrary behavior would involve a *flagrant breach*, and endanger our whole system of contracts." Mr. Hanchett, for the defendants, chiefly confined his argument to an attempt to show that the decisions of the Supreme Court of the United States, in the Kentucky and New Orleans (also largely quoted from by counsel for gas company) cases did not bear upon the moot point at Saginaw. He also made an attack upon the charter of the Saginaw Gas Company, basing his onslaught on purely legal technicality. The papers having been submitted, Judge Brown took until September 8th to arrive at a decision, when he handed down an opinion adverse to the petitioners. "He held that "Saginaw possessed no greater power than a private party, and its action would have amounted to nothing more than the breach of an ordinary contract"—only that, and nothing more—"and would have violated no question of legislative power." Conceding the Saginaw Company's franchise to have been legally granted, Judge Brown asserted there still existed a formidable obstacle to the maintenance of the plaintiff's claim, in that it only contracted to supply the city with gas. How differently the Munich judges thought in regard thereto. But his brightest effort is disclosed at the conclusion of his judgment, for therein he says: "It is well settled that statutes creating monopolies must be construed liberally in favor of the people, and strictly as against the grantee, being justly regarded as an encroachment on the rights of the people, and viewed with jealousy by the courts." In concluding, Judge Brown remarked: "To multiply authorities, in support of my position, is useless. The general principle is too firmly established to admit of any argument. Its application to this case, we think, is entirely clear. The plaintiff took nothing by its franchise but the privilege of lighting the streets with gas, and this it will continue to enjoy so far as its patrons prefer the use of gas to electricity; but its claim to the exclusive privilege of lighting the city by all methods of illumination cannot be supported upon legal principles." To which we may add there is good reason for sorrow that right and justice seemingly do not enter into the "legal principles" established ostensibly for the better government of the State of Michigan.

The second case comes from Appleton, Wis., where the municipality has contracted for public lighting by electricity. About the year 1878 the Appleton Gas Light Company was incorporated, and the authorities conceded to its owners an exclusive 15-year franchise, also agreeing that the city would light its streets by gas for that period. The Company's franchise reads, "shall furnish to the said city and inhabitants thereof a good quality of illuminating coal gas, and continue to do the same until the expiration of the privileges herein granted." Some four years ago, for reasons best known to those who operate the Appleton plant, the manufacture of coal gas was discontinued, and water gas was substituted for it. No fault was found or objection made by the authorities, who, as in the four previous years, kept on under the original agreement. A short time since, however, an electrical craze seized the Council, and a contract was granted to an electric lighting company empowering the latter to illuminate the streets. The pretext upon which this action was based was that the Gas Company had departed from the express stipulation that coal gas should be supplied. Did we not say above that we are a nation of lawyers? But the paucity of the Appleton fledglings in legal lore is more markedly manifest than usual. If "strict definition" is what they are after, the Appleton gas folks might still honestly claim to furnish coal illuminating gas, for the prevalent impression in this vicinity is that coal figures, and sometimes prominently, in the manufacture of water gas. At any rate, the Appleton gas men are not yet ready to appeal to the courts, for they propose to continue lighting the street lamps, and if the authorities refuse to settle the bills therefor the matter may then be adjudicated upon, not by a Circuit Court of the United States, but through ordinary process followed by those who compel delinquents to liquidate their debts.

The Relative Calorific Effects of Tar (with and without Steam) and Coke for Retort Firing.

[Read by the author (F. G. Dexter, of Wormwood Scrubs), at the Twenty-third Annual General Meeting of the British Gas Institute. Reprinted from the *Journal of Gas Lighting*.]

In venturing to bring before your notice these few remarks on the subject of retort firing, I would first mention that the question of "Tar versus Coke" aroused my interest through so great a difference in heating effect being obtained in practice with these two classes of fuel, weight for weight; and this led me to endeavor to account in some measure for the results arrived at in practice by theoretical considerations.

When commencing my investigation the exceedingly complex constitution of coal tar appeared an insurmountable barrier. Its hundred odd constituents—some known, some more or less unknown—did not wear a very inviting aspect for study, particularly as I found, after wading through several works on the distillation of tar, that the relative amount of the different oils obtained on distillation varied considerably—that the quantities of some were not given, and these themselves contained many hydrocarbons of different formula.

In my first rough calculation I obtained, as near as possible, the approximate quantities of the oils usually distilled for; selected formula representing the most common; treated the pitch as carbon; and obtained by this means the relative value of tar and coke as 5 : 3. Following the matter further I determined, after careful thought, on a plan which appeared the most likely to obviate error—viz., to classify the constituents of tar according to their respective boiling points under the different periods of distillation, and to take the average formulæ of the hydrocarbons coming under these divisions as representing the constitution of the oils obtained. These appear in Table I.

TABLE I.—*Constituents of Coal Tar.*

	Average Formula	Weight Per Cent.	Proportionate Weight of Constituents.		Calorific Value.	
			Carbon.	Hydrogen.	Carbon.	Hyd'gen
					Units.	Units.
First runnings.....	C_5H_{10}	3	.025714	.004286	200	148
Light oil.....	C_8H_{14}	7	.061091	.008910	474	307
Middle oils.....	$C_{12}H_{20}$	27	.237073	.032927	1,842	1,145
Heavy oils	$C_{14}H_{16}$	7	.063913	.006087	497	210
Pitch (56 per cent.), composed of—						
Oils	$C_{16}H_{10}$	17.5	.166336	.008663	1,292	298
Carbon	C	27.5	.275000	.....	2,137	.....
Gases and water (H_3NH_3).....	.....	11	.....	.....	.....	.....
			.829127	.060873	6,442	2,108
Total.....			0.89		8,550	

NOTE.—The number of constituents taken was: First runnings, 17; light oil, 26; middle oils, 5; heavy oils, 15; and pitch oils, 4. The boiling points were respectively: Up to 110 deg. C.; 110 to 210 deg. C.; 210 to 240 deg. C.; 240 to 270 deg. C. and upward; and 360 deg. C. and upward.

For the relative heating values of the substances under notice I have taken the results of Favre and Silbermann (see Table II.), they being considered as the most trustworthy, having been executed with the greatest care.

TABLE II.—*Heat Units per Pound.*

Hydrogen	34,462
Carbon	7,770
Coke (desiccated)	7,000
Carbonic oxide	2,400

Heat unit = 1 lb. of water raised 1° C.

Comparing equal weights of these two fuels—tar and coke—(say 1 lb.), the relative proportions of carbon and hydrogen in the former are 0.829127 of carbon and 0.060873 of hydrogen—making a total of 0.89 lb., the remainder being the gases hydrogen and ammonia with water, as shown in Table I. The calorific value of these quantities is—

$0.829127 \times 7770 = 6442$ units for carbon, and
$0.060873 \times 34462 = 2108$ units for hydrogen.

Total..... 8550 units per pound of tar.

In the case of coke, it must be remembered that this substance does not consist of pure carbon. When drawn from the retort and slaked it contains fully 25 per cent. of moisture (as it is generally used for firing up at once, or very shortly afterward), and also ash and sulphur. This moisture not only means a loss in quantity of fuel, but also a loss due to the latent heat and high specific heat of the steam formed. As the sulphur contributes in some measure to the heating value, evolving 2,220 units per pound, I have taken the value given in Table II. for desiccated coke. Deducting 25 per cent. for water, we have $0.75 \times 7000 = 5250$ units per pound of coke, or a relative heating value of coke and tar as 5 : 8. It would be useless, however, for the purpose of comparison, to accept these figures as they stand. Account must be taken of the amount of heat absorbed by the products of combustion, which is necessarily very different considering the nature of the fuels. Multiplying the weight of each product of combustion by its specific heat, we obtain the units of heat required to raise it through 1° C.; and the total of the quantities so obtained is the number of units required to raise the whole of the products of combustion 1° C.

The temperature at which clay retorts are usually worked is about 1,082° C., so that the gases may be taken as leaving the setting at at least this temperature. From the datum 1082° C., the amount of heat removed by the products of combustion of one pound of each of the fuels is obtained by multiplying it by the number of units of heat in the products per 1° C. The figures in Table III. are thus obtained.

TABLE III.—*Products of Combustion of One Pound of Coke.*

Specific Heat.

2.75 lbs. $CO_2 \times 0.2163 = 0.5948$ units.
7.00 lbs. N $\times 0.2438 = 1.7066$ "
0.25 lbs. $H_2O \times 0.4805 = 0.1201$ " (latent heat = 134 units.)

2.4215 units, calorific value.

Then $5250 - 134 = 5116 - 1082 \times 2.42 = 2498$ units for coke.

Products of Combustion of One Pound of Tar.

Specific Heat.

3.400 lbs. $CO_2 \times 0.2163 = 0.73542$ units.
0.547 lbs. $H_2O \times 0.4805 = 0.22392$ " (latent heat = 294 units.)
9.702 lbs. N $\times 0.2438 = 2.36544$ "

3.32478 units, calorific value.

Then $8550 - 294 = 8256 - 1082 \times 3.32 = 4664$ units for tar.

It will be seen that the latent heat of the steam produced is deducted from the heat of combustion in each case. Many errors have been committed by writers on this subject through not observing this; but the reason for the deduction will be apparent with a moment's consideration.

In the experiments determining the heating value of hydrogen the steam produced by its combustion has been reduced to the liquid state; and therefore its latent heat has been delivered up, and is included in the value 34,462 units. But in the case of combustion in the furnace the steam escapes in a highly attenuated state, carrying its latent heat with it, and must, therefore, be deducted to obtain the calorific value for furnace work. The importance of taking into account the products of combustion is thus evinced; the ratio of tar and coke being altered from as 8 : 5 to as 2 : 1 (nearly)—a difference of about 10 per cent. It must not be assumed, however, that the superior calorific value of the tar is wholly due to its hydrogen; for if we take the same proportionate weight of coke as we have for tar—that is, 0.89 lb.—and allow as before for the products of combustion, the ratio is reduced to as 4 : 3.

As you are aware, writers on the question of "Liquid versus Solid Fuel" generally assume that the superiority of the former is due in great measure to the hydrogen contained in it, because hydrogen evolves by combustion about five times the amount of heat that carbon does, weight for weight. That hydrogen does possess this superiority in total heat evolved is true enough; but it does not follow that the same proportion of heat is available in all cases for furnace work. The product of combustion of carbon—carbonic acid—has a specific heat of 0.2163; but the product of combustion of hydrogen—steam—has more than twice this specific heat, 0.4805; or more than twice the amount of heat is required to raise steam through 1° C. than carbonic acid. Again, steam absorbs a large quantity of heat without being raised in temperature a single degree—termed "latent" heat = 537 units per pound. One pound of carbon requires 2⅔ lbs. of oxygen (= 12 lbs. of air) for combustion; whereas 1 lb. of hydrogen requires 8 lbs. of oxygen (= 36 lbs. of air). Therefore the products of combustion of 1 lb. of carbon = 13 lbs.; and of 1 lb. of hydrogen, 37 lbs.—or about three times greater. Thus the high specific heat of steam, its latent heat, and the fact that the weight of the products of combustion is about three times greater, together serve to reduce the calorific *intensity* of hydrogen to practically the same as carbon—a question of considerable importance in furnaces where very high heats are required. The exact figures are 2720° C. per pound for carbon and 2725° C. per pound for hydrogen.

The relative calorific intensity of the tar and coke is as follows:

Coke.... 5250 — 134 = 5116 ÷ 2.42 = 2114° C. calorific intensity.
Tar..... 8550 — 294 = 8256 ÷ 3.32 = 2486° C. " "

This slight superiority is easily accounted for by the fact that the coke contains the greater proportion of incombustible matter.

I regret that the above calculations are not complete, owing to the absence of figures representing the absorption of heat in effecting the decomposition of the hydrocarbons of the tar, which would reduce its calorific value; but not having been yet determined, I was obliged to omit them. On the other hand, I think you will agree with me that the practical heating value of tar is due, in great measure, to its form and ease of manipulation. If we had to charge the furnaces with tar by the hundredweight, and leave it there to "stew," as it were, as in the case of coke, very different results would ensue.

Our ordinary furnaces are to my mind but little better than generators, in which a great deal of the carbonic oxide produced is allowed to escape without being oxidized to carbonic acid with the accompanying loss of heat, and with the additional disadvantage of the large excess of air which has to be admitted. It stands to reason that with the loss of heat by the production of carbonic oxide in a generator, it would be impossible to show an economy of fuel over the old system by the oxidation of the carbonic oxide so produced, were it not that, in the ordinary furnace, so small a percentage of the total heat value of the coke is really utilized. So with tar firing we are able to introduce the fuel in a small constant quantity, in a form much more favorable for intimate mixture with the air supply than is possible with the solid nature of coke; and as a consequence the excess air supply required is much less, the intermittent cooling effect produced by fresh charges of coke avoided, and the carbon of the fuel being (for the reason mentioned) burnt to carbonic acid, a much higher heating effect is necessarily produced.

With regard to the cutting or intense heat generally experienced with tar firing immediately under the middle retort, I think this may be considered as a natural consequence of the results attending the use of liquid fuel. The carbon burning to carbonic acid at this point produces a much more intense effect than the carbonic oxide burning to carbonic acid in the case of coke; and the area of combustion being reduced in the case of tar, owing to its more concentrated nature, may also be in part the cause. The hydrogen plays an unimportant part here, since its calorific intensity is no greater than that of carbon.

I would here remark that although neither a pound nor any other quantity of carbon burning to carbonic oxide, or carbonic oxide burning to carbonic acid, produces anything like the amount of heat evolved by carbon burning direct to carbonic acid, yet it must be remembered that, whether any weight of carbon be burnt direct to carbonic acid, or passes through any intermediate stages first, the total heat evolved is identical in both cases, so long as the same degree of oxidation is reached. Thus 1 lb. of carbon burning to carbonic acid produces 7,770 units of heat. If the carbon be first burnt to carbonic acid, subsequently reduced to carbonic oxide by passing through the incandescent fuel, and this carbonic oxide be burnt to carbonic acid, the heat evolved by oxidation to carbonic acid, minus the heat required to effect the decomposition of the carbonic acid for the formation of carbonic oxide, plus the heat evolved by the formation of this carbonic oxide and the further oxidation to carbonic acid, equals 7,770 units.

Considering now the use of steam with tar, its value in the furnace may be determined by two considerations—first, whether it is itself combustible, and capable of adding to the calorific value; and, secondly, whether it may perform useful service in causing a better intermixing of the tar and air supply. The first supposition may be negatived most emphatically. Steam cannot add a single degree of heat to a furnace by combustion, as is too often assumed. As a compound it is quite incombustible. Decomposed into its constituent gases—hydrogen and oxygen—the most that it can do is to give back to the furnace the heat absorbed in effecting its decomposition. If two substances combine to form a compound, a certain amount of heat is evolved; if the compound is decomposed, exactly the same amount of heat is absorbed. No gain or loss can possibly occur. So, also, if a substance combine with a constituent of a compound, the amount of heat evolved is not equal to the quantity evolved by that substance combining with the constituent in a free state, but is less the amount of heat necessary to effect the decomposition of the compound.

I was much struck with the fallacy of a calculation recently made in connection with this subject, showing that an apparent gain of heat resulted from the decomposition of steam by carbon due to the combustion of the carbonic oxide and hydrogen formed. Fortunately for the surplus, no account was taken of the heat required to decompose the steam, or it would have received a rude shock.

The combustibles of these fuels are hydrogen and carbon; and the supporter of combustion is oxygen. What difference can result, therefore, whether steam be decomposed, its oxygen used to feed the carbon, and the oxygen of the air, in turn, feed the deserted hydrogen, or whether the constituents of the decomposed steam recombine and mate together, and leave the oxygen of the air supply to close with the carbon? None whatever, so long as the same *weights* enter into combination in each case. I think, however, that there is little probability of the steam being decomposed by the carbon in the tar. In order to effect this decomposition in a laboratory experiment, steam has to be passed over a considerable bulk of incandescent carbon, and with the entire absence of air—a very different condition to the comparatively small quantity of carbon widely diffused in a free state in a tar fire, and that, too, in the presence of a considerable quantity of air. It is evident that the carbon would much more readily combine with the free oxygen of the air than decompose the steam for its oxygen.

The second consideration, as to whether steam is an advantage mechanically, is at the best doubtful. It is assumed that the steam vaporizes the tar. But steam, as usually employed, has a temperature of but 100° C.; whereas the first runnings of the tar are the only hydrocarbons that vaporize at this temperature—about 3 per cent. (See Table I.) "Spray" is a better term for whatever heat the steam delivers to the hydrocarbons—latent or otherwise—it must in turn abstract from the furnace. The intense heat within the furnace is the active agent here, and is equally available with or without steam; and considering its high specific heat, and the great difference of its temperature between the entrance and exit of the furnace, a large amount of heat must be abstracted by it, and render it "dear at a gift," if proper combustion can be insured without. Many engineers agree that as good results can be obtained without steam as with it; and others have testified that in other operations the use of steam has prevented their reaching the temperature required.

In adjusting the air supply it should be borne in mind that smoke may be produced through an excessive as well as an insufficient air supply; the former cooling the liberated carbon particles below the point of ignition, and the latter leaving the carbon in the free state through the superior affinity of oxygen for hydrogen—a fact to which, as you know, the light of gas flames is due.

Briefly stated, these considerations show, therefore, that—

1. The effects obtained in practice are corroborated by theory; but that the superiority of tar is due, not so much to the calorific value of the hydrogen contained in it, as to the adaptability of its form favoring the oxidation of the carbon to carbonic acid, with a reduced excess air supply.
2. That the use of steam should be avoided, if possible, as tending to lower the heats.

NOTE.—The specific heats in the foregoing calculations have been assumed to be constant, as the sense of the calculations would not be materially affected if the variations at high temperatures were known and taken into account.

The President said that he had listened with great interest to the paper just read; but the communication contained so many references to numerical questions involving the thermal power of different combustibles, and the diluting effect of incombustible gases, that it would be impossible to discuss it off-hand. The members would have an opportunity of studying it carefully in the Transactions, and perhaps at their next meeting would be in a position to go fully into the questions involved. The paper gave evidence of great care in its preparation, and implied much thought and labor on the part of the essayist. He had to congratulate a young member of their body on having so successfully, and nearly exhaustively, dealt with such an important and complicated problem; and he trusted Mr. Dexter would follow up this contribution with others equally valuable and suggestive.

Mr. Dexter said he should like to add an explanation with regard to the 11 per cent. of water and gases shown in Table I. in his paper. It would doubtless be observed that he had not entered any calorific value for these, or noticed them in the table of the products of combustion. The reason was that in not one of the works on the distillation of tar which he had been able to consult was any information given as to the proportion of moisture, hydrogen, and ammonia respectively in the 11 per cent.; and therefore he did not himself feel justified in stating what these proportions might be. Of course, the moisture would tend to lower the calorific value; but if it was assumed that, of the 11 per cent., 5 per cent. was moisture, 4 per cent. hydrogen, and 2 per cent. ammonia, the calorific value of the free hydrogen and the hydrogen of the ammonia would about compensate for the loss due to the moisture.

The Economical Construction of Gasholders and Tanks.

[Mr. John Somerville, of London, England, read the following paper at the Twenty-third Annual General Meeting of the British Gas Institute. For our report we are indebted to the London *Journal*.]

In presenting this paper for your consideration I am very conscious of my inability to do justice to such a subject as that with which it deals, or even to make it interesting to you; but my desire to add, in however small a way, to our stock of knowledge emboldens me to attempt it, trusting that more

information may be gained in the discussion than may be imparted by the reading of the paper.

In July, 1884, I was requested by the Wellingborough Gas Company to design a tank and gasholder for them as economically as possible. They were sadly in need of storage room, but did not wish to raise much additional capital. This is probably the case with a great many gas undertakings. They postpone as long as they can such necessary work, because of the usual costliness, and from a very laudable desire to keep the capital account as low as possible in these days of keen competition and cheaper gas. But with cheaper gas comes increased consumption, which must be met with more economical working; and one of the most important aids to this is ample gasholder room. If it can be shown that 1,000 cubic feet of gasholder capacity can now be obtained for half the amount it used to cost a few years ago, directors and committees of gas works will not hesitate so long, or be so chary of increasing their storage capacity as occasion requires; thus adding to the efficiency and more economical carrying on of their works, and at the same time removing a load of anxiety from the mind of the manager in the depth of winter. If I can indicate to you how this may be obtained I shall be well satisfied.

It may be well first of all just to look back to (say) 25 or 30 years ago, and mark the progress that has been made in gasholder construction. Previous to that time cast iron was invariably used in the framing of holders—alike for columns, guides, and girders. Then came the first innovation, when the girders were composed of wrought iron. Two angle bars, top and bottom, the same distance apart, were filled in with some kind of pattern of cast iron lattice work, held together by bolts—a composite girder. This gave way to wrought iron instead of cast iron lattice bars between the angle irons, and riveted, which was a great improvement in regard to the strength and stability of the girder. The weak point was their attachment to the caps of the columns, which was usually effected by three or four ⅝ or ¾ inch bolts; and if the girder was a little short by an inch or two, a packing-piece of wood did duty for filling up the space. In time the heads or nuts of these bolts rusted off, and then there was really little or no attachment to the column. But the columns of cast iron were made very heavy; and dependence was placed upon the inert mass and the weight of the column to withstand the pressure of the holder during a gale. It has often been a great wonder to me how they have withstood the fury of a storm of wind. Some, we know, have come to grief.

The next material change was to alter the usual column form, and make it a standard, or stanchion, in the form of a cantilever; thus increasing the resisting power by placing the iron in a better position to receive and sustain the pressure of the holder with a much less weight of metal. This I consider was a great step in the right direction. But following close upon this change came the cheapening of wrought iron. Engineers began to take advantage of this, and found it to be much better adapted for the construction of framing, especially as the necessities for increased and increasing storage made themselves felt, and gasholders were built larger and higher. Cast iron was not well adapted to be piled up high in large and heavy masses. Consequently standards for framing began to be made of angle iron and lattice bars solidly riveted and tied together with the same material; the girders being all soundly riveted and bolted into one strong structure. So that the age of huge, heavy cast iron masses in the shape of columns, dotted around the tank at 18 or 20 feet distance, will soon be numbered with the things of the past, and superseded by the employment of much stronger and safer, lighter and cheaper materials, better adapted in every way for all sizes of gasholders.

Some objections have been raised to the use of wrought iron in framing—such as the risk of rusting; for there is no doubt that wrought iron is more sensitive to atmospheric influences than cast iron, and oxidizes more quickly. But this is so easily guarded against by a coat of paint every two or three years that the risk is reduced to a minimum; and even cast iron columns have to be so painted. Such objection may therefore be dismissed. Then another objection has been made, though I think by people who have not had experience of wrought iron. It has been said that it looks fragile, yields, and does not maintain the rigidity of cast iron. My answer is, "So much the better. It is better for it to yield slightly to increased pressure than to break." Any one passing over the most recent of our bridges will notice how they yield and vibrate; but this is no proof that they are weak; while a flaw or a bad casting in a column will cause the destruction of a gasholder.

I will here notice that in my own experience I have seen three gasholders come to grief owing to the failure of cast iron columns. The first was in the year 1863. I built the gas works at Sittingbourne, and the columns of the holder were of the usual stereotyped pattern for a 60-feet holder—2 feet in diameter at the bottom, tapering to 1 ft. 6 in. at the top, with cast iron girders connecting the caps, attached by the usual three ¾-inch bolts. The holder worked well and satisfactorily for nine or ten months; but one afternoon, during a storm of wind and rain (the tank being full, owing to the overflow having closed), when the gasholder was full up, and the manager absent on business, the wind caused oscillation of the holder and one or two of the bottom rollers to catch on the curb of the tank, throwing the whole weight of the holder on to the opposite columns. The great strain caused them to break short off at the ogee moulding of the base, and over the gasholder toppled, bringing all the columns down with it except two. An eye-witness said that as the cast iron girders snapped asunder one after the other, he distinctly saw flashes of fire as each one broke. I have heard of such a thing before; but I do not know how true it is.

The next disaster I had to do with occurred in 1869, when I went to Dublin. My predecessor left me a legacy in the shape of a ruined cast iron framing. The gasholder (which was not much damaged) had been built about a year previously. It was 120 feet in diameter, of two lifts; and in testing it with air the columns in some way failed and toppled over *en masse*, and when I took charge they were lying around in grand confusion, awaiting the result of a dispute between the company and the contractor as to the responsibility, which was settled shortly after, and I undertook the work of reconstruction. On examination the accident was found to be caused by the spigot joints of the columns having been turned in the lathe so thin, to make them fit the socket, that in some cases there was not ¼-inch of metal left; and when the keys had been driven home many of the spigot pieces had broken off and fallen inside, or partly broken off. The columns were put together by a joint as shown in fig. 1, the socket and spigot turned and

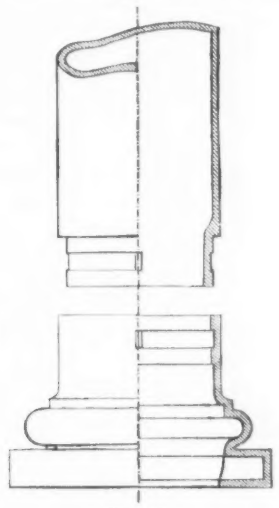


Fig. 1.

slipped together, and tightened by two keys. Here is a case where cast iron columns failed and gave way while adjusting the guide rollers of the gasholder.

The next mishap I had to do with was in December, 1869. I was summoned by telegraph to the Limerick Gas Works, where a gale on the previous night had levelled their new gasholder and columns—a very awkward time of the year, indeed, for a gasholder to fail. It was about 60 or 70 feet in diameter, in two lifts of 22 feet each; was built by a well-known firm of repute, and had been in action for ten or 11 months. On examination it was found that the ogee moulding of the columns, where it joins on to the plinth base, was so thin (caused by the core being too large, or having shifted) that in the majority of the columns there was not in some places ¼-inch of metal just at the very point where the metal ought to have been thickest and strongest. It appeared to be a case of sacrificing strength for the sake of appearances. The ogee moulding had been so undercut, to "show bold," that there was very little metal left, so that when the slightest pressure came, over it went, destroying another holder that was near it in the descent of the columns.

I have long considered the ogee moulding at the base of the column to be wrong in principle. If a fitter wishes to break a piece of iron pipe, he makes a notch all around it, and it snaps easily at that point. So it is with some of the ogee patterns of columns I have seen. Where the column joins the base it is notched or undercut; making this the weakest place in the whole column, where it ought to be the strongest, and when pressure comes upon it it is converted into a transverse tearing strain, instead of one of compression or tension, where the ogee joins the metal of the base at right angles.

Then we occasionally hear of the failure of cast iron columns and girders. One at Beckton, in 1871; another at Northampton, in 1872. Later examples are fresh in our memory, as at Clayton and Kildwick, in 1883, and several others, all attributed to the failure of cast iron columns and girders. Had these gasholders been supported by wrought iron standards and framing I say they would not have failed; and I may add that I have never heard of the framing of a gasholder composed of wrought iron failing in the time of need. And now that gasholders are being built of such large dimensions,

wrought iron is absolutely necessary in their construction; and if it is necessary for large holders, so it should be for medium-sized ones, as iron now-a-days is made in very convenient sections—such as H C T L bars of almost any length, which lend themselves admirably to the building up of standards and girders. None of the disasters I have mentioned could have happened with wrought iron standards, either with the composite strut and lattice, as in the magnificent example Mr. Hunt has lately shown us at Birmingham, or in the built-up web standards and girders of Mr. Livesey, at the old Kent Road works. In both these examples of recent gasholder framing the iron composing the various members is put in the proper place to resist every strain that may come upon them, with less than half the weight of metal, and with consequent economy and efficiency.

Here I would suggest that it is very desirable, when designing framing, to use, as far as practicable, the same size and section of iron. It would be a great convenience to gasholder makers, and tend much to the economy of the structure, if the sections were as few as possible, instead of specifying for small quantities of several sections, as it is often more costly to have a number of sections, and perhaps a small weight of each, rolled. It would also really be more economical, and give much less trouble, if even a stronger and heavier section were employed, if it were all of the same merchantable iron; an extra pound or two per yard would be cheaper than to have to change the rolls for a small quantity of special section. I may say that in the example I am going to quote I tried to carry out this principle as far as I could, and only two sections of iron—channel iron and flat bars—were used; and, as I anticipated, it tended considerably to the economy of the framing. In all specifications of gasholder framing a clause should be inserted that all and every section of wrought iron employed, of whatever size, exceeding this diameter (when the section of iron forming the trussing requires to be strong and heavy) it is more economical to put a timber framing to receive the holder when down. The trussing of a gasholder should never be more than from 10 to 12 per cent. of the floating weight. If it exceeds this it will be found more economical and quite as effective to put the weight of iron into the curb of the crown to stiffen it and give it rigidity. The weight of steel forming the crown curb of the large holder in the Old Kent Road was only about 8 per cent. of the floating weight—a vast contrast to the internal framing and trussing of a recent example of a trussed holder, the details of which are published in "King's Treatise on Coal Gas," where the floating weight is about 600 tons, of which about 180 tons, or about 30 per cent. of the weight, compose the roof trussing. Some engineers do not appear to sufficiently study economy in designing holders, and fancy they get strength if they only put in plenty of weight. But excellence in gasholder construction is not obtained in this way.

The contract for the holder at Wellingborough was about £2,000; its capacity being 287,000 cubic feet. This works out to £6 13s. 8d. per 1,000 cubic feet—a remarkably low figure for a single-lift holder of that size.

The tank also was constructed very cheaply; the ground being specially favorable, as it was composed of about half sand and gravel and half blue clay. Advantage was taken of this to build a tank of Portland cement concrete, 7 parts to 1, and puddled at the back of the wall with the clay, which made it perfectly water-tight without rendering the face of the tank. Concrete was put over the cone of clay in the center to the thickness of 6 inches. Where such favorable conditions existed no skilled labor was required. In a tank that had been built some ten or eleven years before, on the same ground, the clay was excavated and made into bricks, and then skilled labor

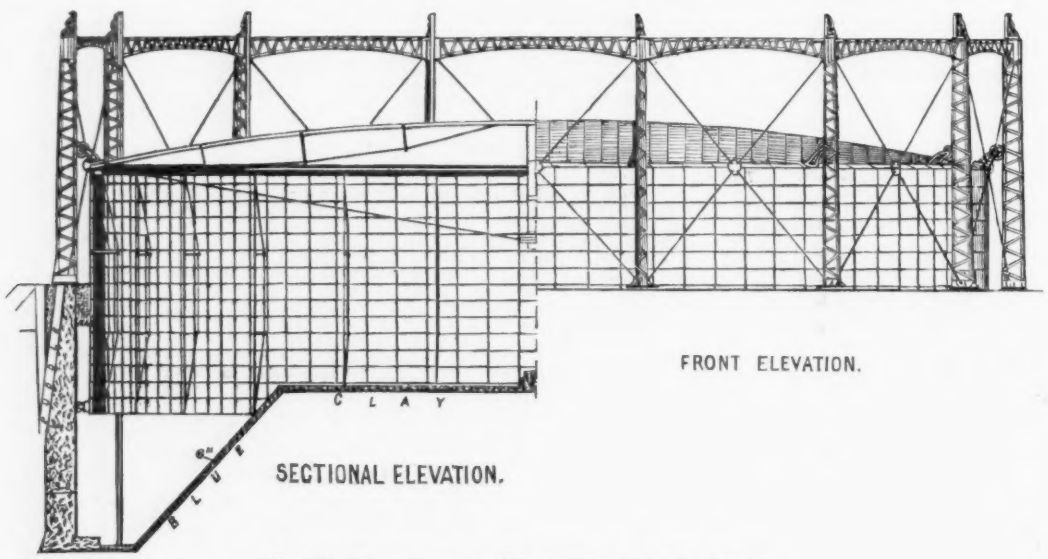


Fig. 2.—Holder at the Wellingborough Gas Works.

should withstand a tensile strain of 21 tons per square inch; and it is well not only to so specify it, but to have lengths of each section submitted to actual test.

The holder for Wellingborough [see fig. 2] may be taken as a medium-sized one; the tank being 114 feet in diameter, and 31 feet deep, the holder 110 feet in diameter by 30 feet deep, having a cup instead of a curb at the bottom, ready for telescoping at some future time when required. The framing is of wrought iron, made with two channel iron bars, 6 in. by 3 in. by ⅛ in.; the front one acting also as a roller path, the back one as a strut 2 ft. 6 in. wide at the bottom, tapering to 1 ft. 6 in. at the top, connected together with lattice bars 3 in. by ⅛ in., securely riveted. The girders are formed also with two channel irons, 3 in. by ⅛ in.; the lattice bars of flat iron, 2 in. by ⅛ in. They are brought down at the ends to 2 ft. 6 in., in order to get a better hold of the channel iron standard, and secured thereto by eight 1-inch bolts. The framing is further strengthened by 1¼-inch diagonal tie-rods, which bind the whole structure well together; and although it may not be a "thing of beauty" (gasholders very seldom are) I have no doubt it will be a source of "joy" to the manager for a good many years to come. The whole weight of the 14 standards and girders, etc., composing the framing is only about 36 tons. Had it been of ordinary cast iron construction it would have weighed about 90 tons; and as the difference in price of the metal is not so very great, you see where the economy comes in.

The other parts of the holder do not call for any special mention. It is trussed in the crown, as I found a light trussing would be some £5 cheaper than a wooden framework erected in the tank to receive the holder when down; and for holders up to 120 feet in diameter it is cheaper to put in a light trussing than to place a wooden framing in the tank. With gasholders was required to build them into the tank—thus increasing the cost more than double; but in this instance a circular timbered trench was made. The mixed sand and gravel was not taken out of the tank, but converted into concrete and deposited in the trench, backing close up to the face of the excavated clay, the whole depth of it—13 to 15 feet; so there is not much chance of the tank giving way at the bottom. As the ground on one side of the tank had to be raised some 5 or 6 feet, three hoops of iron were imbedded in three courses, 2, 4, and 6 feet from the top, in the concrete walls, 3 in. by ½ in., having the ends clasped; thus forming perfect rings, and adding greatly to the stability of the structure at little cost. The foundation of the tank was as simple as it was possible to make it. No costly elm boards or large flat stones were employed; the blue clay was trimmed off clean and level; a set-off or toe-piece cut out of the clay at the back of the wall about 12 inches, and the whole filled in with solid concrete.

The contract for the tank was £1,500, which works out at £4 14s. 6d. per 1,000 cubic feet capacity—I think, without exception, the most economical tank I ever heard of.

In conclusion, I would say that engineers would do well, in designing framing, to follow, as far as possible, on the lines laid down in the example so admirably set before them at the Old Kent Road works, by Mr. G. Livesey, who, with justice, may be called the pioneer of wrought iron framing; for although, as we all know, this material was used years ago for framing, it was never employed in the way in which he has shown it may be employed, having regard to strength, durability and economy.

Since writing this paper I thought the members would like to see a model of a proposed standard suitable for a gasholder 100 feet in diameter by 26 feet deep, which is perhaps the size most generally made. This will show

my meaning better than the drawing. The model is constructed to a scale of ½ inch to the foot, for a standard 26 feet high, 2 feet wide at the base, and tapering to 1 foot at the top; and is made of a 6 in. by 3 in. by ¼ in. channel iron, and 4 in. by ½ in. flat bar at the back. The weight of it will not exceed 8 cwt.; and it will resist a wind pressure on such a sized gasholder of 40 pounds per square foot, which would amount to about 24 tons on the holder, divided amongst four of these standards, or 6 tons to each. The usual pattern for a cast iron column for a holder of the size named would weigh about 3½ tons, and cost three times as much as wrought iron.

Discussion.

Mr. G. Livesey desired to disclaim the credit attributed to him in the closing paragraph of the paper of being the pioneer of wrought iron construction. The late Mr. Innes, of the Phœnix Gas Works, erected at Kennington, in 1854, a gasholder which had a wrought iron frame consisting of columns made of boiler plate. Mr. Anderson, too, was a long time before him (Mr. Livesey) in designing wrought iron framing; and others also had done the same. With respect to this kind of framing, there was no doubt that when it was a question of large structures it was essential. As to gasholders not being "things of beauty," he had had the pleasure, a few days previously, of seeing Mr. Hunt's large holders, and thought they were really beautiful structures.

Mr. C. E. Jones (Chesterfield), in support of the contention that a gasholder column was an unsafe structure, said he was hoping that the old turned and bored joint in the case of these columns had been condemned long ago. The proper form for a column was, in his opinion, that on the lines of an oak tree—spreading out at the base, something like the Eddystone and other lighthouses. If people would use cast iron, and desired to have a firm and solid erection, the flanges should not be on the inside, but on the outside. Then they could be sure that all the bolts had been put in by the contractor; and if any of them should give way after a storm, an outside inspection would detect the failure. It was very seldom indeed that any inside inspection of gasholder columns could take place. In his own experience he was in favor of the lighter and more elegant wrought iron framing; but at the same time there were circumstances under which it was desirable to use cast iron.

Mr. G. Livesey said that he had intended to compliment Mr. Somerville on the skill he had displayed in designing a gasholder. His essential object was to construct one as cheaply as possible; and he (Mr. Livesey) thought in this respect he must take the palm from them all, while the work appeared to be carried out most satisfactorily in all particulars.

The President said it was of very great importance to be enabled to construct gasholders at a moderate price; and the members would all agree that it would be scarcely possible to use material more efficiently, or to devise a cheaper form than that which Mr. Somerville had indicated. He (the President) was glad the author of the paper had pointed to the essential weakness of the section at the ogee moulding near the base of cast iron pillars. This was due to the idle attempts of architects who tried to imitate in a new material what was only suited to an old one. They had endeavored to copy in iron what was suitable only for stone. One of the great abominations in architecture, from which they had been in a great measure relieved in modern times, was the absurdity of trying to represent in iron architectural forms originally designed for and applicable to stone. He recollected the time when it was thought that the solid iron columns which supported a kind of balcony projection in the Quadrant at the foot of Regent street were "things of beauty;" but he was glad to find they had long ago gone into the melting pot, from which they ought never to have issued.

Prof. Orton, on the Gas and Oil Fields of Northern Ohio.

Prof. Edward Orton has made public a preliminary report covering a portion of his researches and conclusions gained through an investigation of the newly-discovered gas and oil fields of Northern Ohio. The "preliminary report" comprises a pamphlet of 76 pages, suitably illustrated by diagrams and maps, and is well worth a careful perusal. We reprint his—

Conclusions as to the New Fields.—1. From the facts already stated it is obvious that the discovery of oil and gas in the Trenton limestone of Northern Ohio is invested with great economic interest and importance in the localities that have been specially named. Fuel of such character as Findlay gas has become in our day a factor of the greatest value in many lines of manufacture, and the towns that can secure it gain such an advantage that competition with them is difficult or impossible on the part of towns that are without it.

Oil is in like manner power. In addition to all other uses it furnishes the best of fuel. Excellent facilities for using it as fuel have been provided of late, and some of these are already introduced on the large scale into Lima and adjacent towns.

The eager search for the new fuel, whether gas or oil, that has been going on, and that is still continued in the State, is fully explained, and in a measure justified by the extraordinary value of these substances when found at their best.

2. The supply of valuable accumulations of oil and gas from the new horizon has thus far been found to be very sharply limited. There are four productive centers at the present time. Others will doubtless be added, but probably within or near to the general boundaries already pointed out. The inference that was hastily drawn from the experience of the towns that led in the search, viz., that all of Northern Ohio is good oil and gas territory, has been proved to be unfounded. The oil of Pennsylvania and New York has all been derived thus far from less than 400 square miles of working territory, but these 400 square miles are distributed through many thousands, and even through tens of thousands of square miles. The production of the Trenton limestone in Ohio may prove to be as sparsely and as apparently capriciously distributed throughout the districts which it is known to underlie as is the production of the great sandstone sheets of Pennsylvania.

3. The productive territory lies in *spots*, and the different centers cannot be connected by any lines or belts that it is at all worth while to draw. Any two places can be joined on the map by a straight line it is true, but not a line can be drawn between the productive districts at present known which is not broken by failures where drilling has been attempted, and no line has yet been found that would lead the driller to fortune. The northeast and southwest line, derived from Pennsylvania experience, is perhaps the favorite direction in the new field also. Lima lies to the southwest of Findlay; so far, good; but in the same line lies Fostoria with two dry holes, Fremont, without a single well in the Trenton that deserves mention, out of a total of eight wells. Between Lima and Findlay wells have been drilled at four points, viz., Beaver Dam, Bluffton, Mt. Cory, and Rawson, and all are failures. To the southwest of Lima is Celina, where the Trenton is reported unproductive. Out of a total of nine locations on this line two are productive.

Another line on which great expectations have been built is the north and south line connecting Findlay and Bowling Green, but the line is broken in the middle and at both ends. Between Bowling Green and Findlay the New Baltimore well has showed unproductive ground, at least in the first well. North of Bowling Green are the three unproductive wells of Toledo. South of Findlay, Arlington, Kenton, Belle Center, Urbana, and Springfield have made an unavailing search for oil or gas in the Trenton. In this case two localities out of nine in the line have proved successful. Such lines or belts, it is obvious, are worse than none.

The Canada oil field is frequently included in the same belt with Lima and Findlay, but the Canada oil is derived from a rock that is not present at either of these last named points. Its place in the Findlay scale would be 300–400 feet in the air. The Corniferous limestone is the Canada oil rock, and the Trenton is never approached within a thousand feet in this field, and, moreover, there is good reason to believe that the Trenton arch in Ohio was formed ages before the Canada oil rock was deposited.

4. The most important line of facts that has been brought out thus far by the study of the field is the connection which is found to be maintained between the productive areas of the Trenton limestone and the level which its surface holds with reference to the sea. All of the present production is derived from a quite narrow range of elevations. The gas wells of Findlay find their supply where the limestone lies between 306 and 350 feet below sea level. The *great* gas wells of the field are thus far included in the interval between 330 and 360 feet, both included, below sea level. The gas wells of Bowling Green, including Portage, all find the Trenton at 380 to 400 feet below the sea.

The oil of the several fields has scarcely a wider range. The deepest steady supply of oil comes from the Matthias well, at the foot of the Findlay slope, where the Trenton limestone lies 481 feet below the sea. The bulk of Findlay oil, however, comes from between 400 and 460 feet below the sea. Lima oil is derived from the Trenton where its surface ranges between 390 and 400 feet below the sea. It is highly probable that wider limits will be established under the active development that is going forward, but up to the date when the facts were taken, all the wells agreed fully with the statements here given.

In the Lima district the descent of the surface of the Trenton to 400 feet or more below sea level is instantly fatal to it as a source of petroleum.

In no case has oil thus far been produced in any persistent supply from the Trenton limestone where its surface is 500 *feet below the sea.* The deduction is obvious. Where the surface of the limestone is found 500 feet or more below the sea, one well is enough to determine the character of the immediate field, according to present knowledge. The Carey wells mark the limit in this direction. The Trenton limestone here lies 513 feet below sea level.

The provisional character of this conclusion is fully recognized. It will lose its validity when set aside by a new fact, but so long as it is maintained it can be made useful in limiting exploration as already suggested. Large

districts are promptly condemned by this deduction. It may be charged that this is a prophesy after the fact, that only by the failure of the well can the law be extended. It is true that a certain amount of exploration must precede a valid conclusion, but the latter is by no means limited to the particular districts in which the exploration is carried on. Take, for example, the drilling that has gone forward in towns on the Dayton & Michigan Railroad north of Lima. In the well drilled at Columbus Grove the Trenton was struck at 526 feet below sea level; in the Ottawa wells, at 639 feet; in the Leipsic well, at 701 feet, and in the Weston well, at 905 feet. At Toledo, also, its surface was found 800 feet or more below the sea. Not only is further drilling in these localities discouraged by this conclusion so long as it stands unimpeached, but the geological structure of the counties to the west of this line is such as to make it certain that their condition is worse in this respect than that of the towns that have already experienced failures. That is, the Trenton limestone lies lower in them than in the regions already found barren. In Van Wert county, however, west of Lima, the Trenton is found at a level more favorable, so far as this deduction is concerned. Its surface in the Van Wert well is 434 feet below the sea, and in the Delphos well, 447 feet below. Further exploration may well enough be undertaken in this region.

By the application of the same deduction the eastern boundary of the field lies along the line of the Columbus, Hocking Valley & Toledo Railroad. Wells have been drilled on this line at Marion, Upper Sandusky, Carey, Fostoria, Bradner and Toledo. The record of the Marion well is not satisfactory. According to the current figures the Trenton limestone here lies at about 700 feet below the sea; at Upper Sandusky it is 470 feet below; at Carey, where it produces a moderate amount of gas, it lies 513 feet below; at Fostoria, where two dry holes have been drilled, it is 472 feet below; at Bradner, 529 feet below; and at Toledo, as previously stated, about 800 feet below sea level.

The line of elevations here given belongs, of course, to the counties already named. There is no known significance as yet, outside of these districts, in the fact that the Trenton limestone lies 300 or 400 feet below the level of the sea, so far as oil or gas production is concerned. The limestone, as already shown, rises slowly to the southward. Its upper surface reaches sea level not far from the parallel of Dayton. At Cincinnati it is about 200 feet *above* sea level, though still buried several hundred feet deep, and in the valley of the Kentucky river it rises to-day, having here an elevation of 500 to 600 feet above the sea. Through the northern portion of Darke county, through Shelby county, and probably through Logan, there is an arrest of the northward dip and a small reverse dip is established. The Trenton lies 40 feet higher at Union City, Ind., than at Greenville, and 40 feet higher at Sidney than at Piqua. This interruption might well be expected to connect itself with oil or gas accumulation, but so far the limestone in this belt has proved entirely barren.

The deduction as to the connection between its petroliferous character and its absolute level is not, therefore, to be applied much beyond the south line of Allen county, according to present experience. It seems almost certain, however, from the latest developments, that portions of Auglaise and Hardin counties will yet be found to hold valuable stocks of oil or gas. They are very closely connected with producing territory. But the result of a considerable amount of drilling done to the south of this line is certainly discouraging. At no point has the limestone been found charged with oil or gas in sufficient quantity to pay for the present or to warrant further exploration. More than 25 wells, distributed through thirteen counties, have been sunk to the Trenton limestone within this district, but the rock has not yielded to a single one of them any adequate return in the way of light or heat. At Cincinnati these wells do indeed furnish power, but it is water power. They have proved artesian wells, and the strong flow which they send out from the deeper courses of the Trenton is utilized in elevators. New wells are being drilled for the express purpose of securing this form of power. The deep water of these wells is quite highly mineralized, and is popularly identified with the Blue Lick water of Kentucky. Some value is attached to it as a medicinal water at several points where it has been reached.

In the accompanying map of a number of counties* of Northwestern Ohio, the areas in which the Trenton limestone is found more than 500 feet below sea level, are indicated by shading. The northwestern and northeastern boundaries are established on a larger number of facts than the remainder. In Hardin county, particularly, and also in Logan, the lines laid down have but little to rest on, and not much reliance is to be placed in them. Much of the boundary is provisional only, and when more facts are in hand the included areas will possibly be represented by an archipelago instead of by a single mass. One outlier of Trenton, less than 500 feet below sea level, is to be noted at Upper Sandusky. The surface of the rock here is reported at 472 feet below the sea.

*Lucas, Fulton, Williams, Henry, Defiance, Paulding, Putnam, Ottawa, Seneca, Sandusky, Wyandot, Marion, and East Hardin.

No large production of oil or gas has been obtained in any of the shaded areas thus far, but it is not to be inferred that all of the unshaded portion is promising territory. Much of this has been already found barren by the drill. It is also to be considered fairly probable that accidents of structure like those described in Findlay may somewhere determine production in the regions that thus far we have been obliged to condemn.

It is believed that this conclusion can be applied with great profit to the regions in which drilling is going forward. The towns may still insist on making their tests, but one will perhaps suffice when the record shows the lower limestone to be at a level from which no value has yet been obtained. In fact, all new drilling for Trenton limestone oil or gas, in the shaded areas, might well enough be left in abeyance until at least one success is registered in such territory. There are a score of wells now under contract in these clouded districts, and if their records all agree with the records already made, it will be as nearly certain, as most things are that we call certain, that no new well will repay its projectors. A line showing the 400 feet levels of the Trenton would come much closer to actual production than that here represented, but for the present we must be content with rough approximations to boundaries.

5. The drilling that is now going forward, and that is likely to be continued in the western half of Ohio for some time to come, seems likely to bring little or no reward in money value to the communities that undertake it, outside of the three or four counties previously named. It makes a redistribution of a good deal of accumulated wealth, but the labor is essentially unproductive in character—that is, it does not seem likely to add to the material resources of the parties that make the outlay. There is, however, another side to the question which deserves consideration. The drilling of a deep well in the drift-covered plains of Northern Ohio is an educating agency of no mean order. The record, as the work progresses, becomes to a whole community almost like the experience of a journey into a foreign land. A new field of thought is opened, and new ideas come in at every stage. The oil and gas excitement of the last two years has done a great deal to promote the intelligence of the communities through which it has extended.

To an ambitious company that has made liberal investments in the hope of gaining a prize in the lottery of petroleum production, the result here named may seem a very intangible and unsatisfactory one, but for a great many of the towns that have drilled, it is either this or nothing. The money spent in drilling to the Trenton limestone in Western Ohio during the last year makes a large aggregate, and most of it may be counted as water poured out on the ground, except for these indirect advantages which have no place in ordinary balance sheets. If such elements are not recognized, then Ohio has been a great loser by the discovery of Findlay gas and Lima oil.

It is the lottery element in petroleum production that gives to it most of its fascination. As in the search for other forms of mineral wealth, there is the possibility of getting large returns for small outlays. Science has no key with which to unlock these buried treasures in advance of exploration. No knowledge and no sagacity could have located the oil field of Lima, for example, in advance of the driller, but after a certain amount of exploration is done, deductions are often possible by which further work may be guided to some extent. This now appears to be the case in regard to the new oil horizon of Ohio. The element of chance still remains a factor, but the drilling already done suffices to show that outside of certain narrow boundaries the dice are at least loaded. Each new failure gives new validity to the interdict against drilling that the results of one year's explorations have applied to large sections of Western Ohio.

The facts here presented, when candidly considered, will discourage much of the promiscuous drilling that is now going forward. Especially will they discourage the drilling of second and third wells in many localities where the first well was, in all intents, a failure. The excitement that has pervaded the State is largely due to the sensational and exaggerated reports that have been sent out from the points where drilling has been done by persons gathering news for the press. To one deriving his information from newspaper paragraphs alone, the inference would be warranted that Northwestern Ohio is one great pool of petroleum, charged with high-pressure gas, and ready to flow out in streams of fabulous value wherever the drill is sunk to the rock that contains it. Much of the production, especially of gas, has been exaggerated a score of times, and some of it even hundreds of times. In one instance a well was credited in published accounts with 385,000 feet of gas per day, where the measurement showed 1,270 feet. The exaggeration is not, as a rule, intentional, but it results largely from the unfamiliar character of the facts. It will doubtless diminish as knowledge of the subject becomes more general.

A Well Attended Exhibition.—Those in charge of the "Colonial and Indian Exhibition" have good reason to be satisfied with the interest taken by the public over their efforts. The number of visitors for week ending August 21st is reported at 210,303, which brought the total, up to that date, to 2,821,706.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, Aug. 17, 1886.

Those Beastly Paraffin Lamps.—The Effect of Burning Tar in the Retort House on the Finances of the South Metropolitan Gas Company.—The Gas Light and Coke Company and Tar Burning.—Electricity and Gas.—The Avery Gas.

The readers of the AMERICAN GAS LIGHT JOURNAL may be interested in the following opinion expressed in a paragraph which recently appeared in the *Lancet*, the leading journal for the medical profession in England, and therefore of great weight with the public generally. It is headed, "A Word for Members of Parliament."

"This one is a lamp explosion case. The mother was turning down the wick of a cheap paraffin lamp, when it exploded and burned the child all over. 'Those beastly paraffin lamps!' exclaimed Dyer. 'You may well say that,' continued the House Governor. 'Every week we have to admit several people suffering from burns and explosions, and they say that nearly every week an inquest is held in London on somebody killed by them. Parliament insists upon safe lamps for the mines, but, considering that hundreds of people throughout the country are annually burnt or killed by oil lamps, why does it not insist upon safe lamps for the masses? Most of the cheap lamps might be labeled 'Certain death, or the house on fire if upset;' and the manufacturers know it. Do you know that one-fifth of the fires in London are caused by mineral oil lamps?'"

Since Mr. George Livesey, at an early period of the year, advocated the policy of burning tar in the retort house, and announced that his company had embarked in it, the statement of accounts for the half year ended June 30 last has been looked for with interest. There is also another reason why, on this occasion, the accounts of the South Metropolitan Gas Company have attracted a more than ordinary share of attention; and that is the bold step taken by the directors at the beginning of the year in reducing the price of gas to 60 cents per 1,000 cubic feet—a reduction which scarcely appeared warrantable, seeing that it would involve a loss of revenue to the extent of $200,000 per annum, while the surplus profits for the previous year amounted to not much over $40,000. The directors looked to increased business as a source from which this large difference was to be made up, which implied either a keen knowledge of their district or else a large measure of faith. But the result shows that they knew their own business best. An increase of consumption to the extent of 9 per cent. as compared with the corresponding six months of last year has been experienced, and notwithstanding the fall in the value of tar and ammonia, and other adverse circumstances, they are able, with the aid of a dip into their ample undivided profits to the extent of $25,000, to pay full dividends as allowed under the sliding scale—viz., 13 per cent. In their report the directors state that tar is worth 3 cents per gallon to burn.

As compared with the corresponding period for 1885, the actual receipts for gas show a slight decrease. There is an increase to the extent of 9½ per cent. in the receipts for rent of meters and stoves, but the residuals show a falling off of 8 per cent. This is principally due to the item of tar, which has realized less than half the sum received for it in the previous year. The expenditure shows only a slight increase, notwithstanding the increased make, and the amount of profit actually earned is $653,750—only about $12,100 less than last year.

The total make of coke during the six months was 3,256,851 cwt.—being at the rate of 12.4 cwt. per ton; of which quantity rather less than one-fourth, or 779,672 cwt., was used as fuel. The tar produced amounted to 2,625,231 gallons, of which quantity only 351,903 gallons were used as fuel. During the greater part of the year the tar firing was simply in an experimental stage; so we may gather from this that the South Metropolitan has commenced to use tar in earnest. Indeed, it is stated in the report that orders have been given for a great extension in the use of tar fires. The quantity of coke used on the works during the six months ending June 30, 1885, was 801,707 cwt., although the production was less by some 150,000 cwt.; so if we add one-fourth of this increase—say 37,500 cwt.—to the 22,000 cwt. actually saved, and make a small deduction for tar used for other purposes, calling it roundly 350,000 gallons, or 35,000 cwt. of 10 gallons to the cwt., it is evident that practically each ton of tar has saved two tons of coke for sale. The 2,477,179 cwt. of coke actually sold realized $353,300, or about $2.85 per ton. So it is evident that tar is worth $5.75 per ton to the South Metropolitan Company as a fuel, and that if they cannot get this price for it they will do well to burn it. As it appears from the accounts that the tar sold during the six months averages not much over $2 per ton, the wisdom of the order for a "large extension in the use of tar fires" is manifest.

The Gas Light and Coke Company has been found fault with for not being more energetic in taking up this matter of tar firing, and I think without reason. A little cogitation over the above statistics will show that the chief thing to be considered in connection with the burning of tar in the retort house is the selling price of coke. It is known that this Company possesses extensive works for the manufacture of tar products; and the value of these is evident from an inspection of the accounts for the six months ended June 30, 1886. We have seen that the price obtainable by the South Metropolitan Gas Company for the tar they sold averaged a little more than $2 per ton; but the Gas Light and Coke Company is able to show a return nearly double, or at the rate of $4 per ton. It is well known that the operations of the latter Company are carried out on a gigantic scale. During the six months in question they produced more than 10,000,000 cwt. of coke. In order to get rid of this enormous quantity they are obliged to ship large cargoes to foreign parts at cheap rates, and the result is that the actual net returns to them are little more than $1 per ton for coke. So it would not pay them to burn tar, even if they had to sell it at the rate obtainable by the South Metropolitan Company, or something less—say at $2 per ton. Much less, then, will it pay them while they possess an extensive and well ordered tar works. Why should they burn $4 worth of tar to save $2 worth of coke? No doubt these points have been duly appreciated by the very competent staff of engineers engaged in carrying on the operations of the Company, and hence the indifference shown by them toward the use of tar in the retort house. Those who complain against them on this head have evidently formed a hurried and ill-considered opinion, founded on the data published by the South Metropolitan Company, or else they are incapable of fully investigating and grasping the whole bearings of the question.

This is a good illustration of the mistake so often made, especially by introducers of new processes, in taking data obtained at one gas works and holding it up as a universal rule applicable to all and sundry. It has been well said that "what is one man's meat is another man's poison;" and similarly a mode of procedure that might prove the salvation of one gas company would nearly ruin another. The cautious gas engineer never jumps at conclusions founded on this sort of data, but takes it home with him, and tries how it appears to fit when laid side by side with his own peculiar circumstances. Mr. G. Livesey is to be congratulated on his foresight in taking up tar firing; and the engineers of the Gas Light and Coke Company deserve equal congratulation on their foresight in leaving it alone.

It has been alleged amongst electrical circles, including scientific electricians and commercial electricians, and some who have ingeniously combined the two characters, that the electric light act of 1882 had the effect of preventing, or at any rate hindering, the practical application of the electric light in England, and it is blamed for the fact that this method of illumination finds so little favor here. The plain fact of the matter, perceptible to any business man of ordinary perspicuity, is that electricity cannot touch gas at 60 to 70 cents per thousand cubic feet, as now supplied in all our principal towns. The electricians do not care to admit this very obvious fact, and so, almost every year, endeavors are made by them to get some of the objectionable clauses repealed in Parliament. An unsuccessful endeavor has been made this session, which would not be worthy of notice but for the fact that an inquiry, embracing the examination of some score of witnesses, was held before a select Parliamentry committee. The evidence was remarkable for that want of reliable practical data respecting the cost of the light, etc., that has always been noticeable in these inquiries. The best authorities in the country were examined; but, while willing to enlarge in general terms upon the advantages of the light, the desirability of investing therein, and of putting down installations, etc., they failed to give that definite information which it is the object of these inquiries to elicit. A remarkable diversity of opinion existed amongst the experts as to whether any important improvements had been made since 1882 in connection with the generation or distribution of electricity. Some knew of no improvement in distribution, and others quoted new inventions calculated, in their opinion, to greatly facilitate this department. The only thing on which they agreed was that the act was entirely to blame as the main if not the sole hindrance to the development of electric lighting. Against this, however, several representatives of corporations, including Sir G. Morrison, the town clerk of Leeds, who had tried the electric light under the regulations of the act, were unanimous in agreeing that the great cost of the new system had been the real reason for discarding it. With all this conflict of evidence, it is no wonder that the committee failed to extract any definite information to serve as a basis for alterations in the act.

It is questionable whether, during the past five years, gas lighting has not advanced more rapidly than electric lighting, and the difference in favor of the former is not greater at the present day than in 1882. Not only has there been an all round reduction in the price of gas, but the use of larger burners, including those of the regenerative kind, has become very general. "Sugg" and "Bray" cast their mild but brilliant effulgence at every principal street corner, and in front of almost every important public building; whilst "Wenham," "Clarke," and "Bower" are common objects in shop windows. It is known that these new burners afford a great increase in the lighting value from a given consumption of gas, as compared with ordinary

fishtail and batwing burners. The electricians have been accustomed to base their estimates of the value of gas lighting upon the results afforded by the smaller sizes of common burners; but the results obtainable by the use of these modern burners are now generally so well known that they cannot be gainsaid. If the best authorities in the gas world had been examined as to whether any improvement in the gas industry had been effected since 1882, they would have been unanimous in the affirmative; and the task of smashing up the gas interests, once claimed by electricians as being well within their power, daily becomes more and more difficult.

A new gas, called the "Avery" gas, and said to be an American invention, has just been turned into the mains in the town of Cleckheaton in Yorkshire, this being the first practical attempt to use it in England. The staple material of this "Avery" gas is shale oil refuse, or the residue remaining after extracting paraffin from crude shale oil. This waste substance, it is stated, can be obtained in large quantities at 1d. per gallon; and one gallon will yield more than 300 cubic feet of gas. By simple proportion, then, it is deduced that 1,000 cubic feet of 30-candle gas can be obtained at a cost of 3d. How very obliging this "refuse" must be to deliver up its gas free of cost—no wear and tear of apparatus, no fuel for heating, no wages, etc. A further source of gratification to gas engineers will be the knowledge that in buying up this "refuse" they are assisting in the development of the paraffin oil industry. On the strength of a day or two's trial at Cleckheaton it is assumed that the gas is perfectly satisfactory, and a beautiful picture of the prosperous condition to be attained by an undertaking yet to be formed, to buy the shale coal, first extract and sell the oil, and then to utilize the residue for the production of 30-candle gas, costing only a "few pence," is drawn. But we must await the results of say a month's supply of the "Avery" at Cleckheaton before forming any decided opinion on the matter; meanwhile all appears to be as rosy as first installations of new processes usually are.

Notes from the West.

By Retort.

The improvements and enlargements that have been made on gas plants in the West this season have been numerous and extensive, although perhaps these have not tended quite as much as usual in the line of extensions to street mains, but rather to a greater extent than formerly in the direction of augmenting the capacities of the works themselves. The gas trade indications of the early fall season all point to an unusually large volume of business for the coming winter. Unquestionably the trade outlook generally is better than that noticed for several years back, and there is no other thermometer of trade equally sensitive to the ups and downs of mercantile prosperity, or that is more certain in its readings, than that afforded by the business of gas companies. The competition of electric companies has stimulated the lighting industry, and, as an advertising medium, will very materially increase the use of artificial light. Another element which has contributed more noticeably still to this state of affairs is the constant reduction in price—a movement which has been so general in all of our Western cities.

Under these three incentives—competition with electricity, cheaper rates, and greater business prosperity, the outlook was never more promising. The writer has just returned from a trip extending into six of our Western States, and finds that the above statement will truthfully portray the gas situation. Indeed, in some instances, the wonderful growth of the cities was almost too great for the gas makers.

Kansas City, Mo., as usual seemed to be booming. The history of this company has been little short of one continuous struggle to keep up; but under the able management of that "hustler," Harry Clark, it has not only done so, but has always had a trifle to spare. It is refreshing to find the old *regime* in possession of the Kansas City plant after the desperate struggle on the part of certain parties to capture it, and still more pleasing to know that they propose to hold *their own*.

Natural gas has been struck at Fort Scott, Kansas, and I was not long since shown a letter from a citizen of that place, who is interested in the natural gas plant, in which the writer invited an acquaintance of mine, who is a capitalist, to invest, with himself and others, for the object of purchasing the Fort Scott Gas Company's plant, and thus to secure the entire gas business of the city. Has Brother Scofield become so wedded to "his own vine and fig-tree" that he desires to relieve himself of his gas interests and become a veritable granger?

At Wichita, that wonderful city of Kansas, the gas company has been unable to keep up with the rapid growth and spread of that booming locality. Were the capacity of the plant doubled to-day it would not be any too large for catering to the needs of the district to be supplied. Between the gas company and the two electric lighting companies, however, the denizens are not suffering for want of light. A local company operates one of the electric plants, and the gas company controls the other. At present a most bitter warfare is being waged, lights being furnished for $6 each per month, and the scale still shows a very conspicuous downward tendency. The gas works and electric plant are owned by Judge Hill, of Fort Scott, and this fact, coupled with the limited gas plant, works as a disadvantage in the triangular fight. With reorganization and a reconstruction of the gas plant, which means a very material enlargement of it, these difficulties would be easily adjusted, and would undoubtedly mean a veritable business boom, or one in proportion to the mushroom-like growth of the city.

The new plant of the Paducah (Ky.) Gas Light Company was put in operation last week. These works were built under the supervision of Mr. I. C. Baxter, Supt. of the Evansville (Ind.) Gas Company. They are model works, and Supt. McCoy proposes to give Paducah good gas at low rates. The old works were abandoned none too soon.

In these days of close competition, and when gas men are industriously seeking for successful means of fortifying their already strong position in the matter of gas vs. oil and electricity, it will amply repay gas managers to visit the Exposition now open and in progress at Cincinnati, Ohio, if for no other purpose than to witness the beautifully illuminated buildings, exclusively lighted by gas consumed in the O'Neil patent burners. In these immense buildings the illumination is so complete that it is the subject of remark on all sides; and it is especially gratifying that one misses the sense of uncertainty always surrounding the use of electric lights. The large space is flooded with an evenly distributed, thoroughly diffused light which thoroughly illuminates every nook and corner, and nowhere creates the black shadows peculiar to the arc light. To those not familiar with the O'Neil burner we would say it is very similar in appearance to the Lungren; and, like the latter, yields a very large ratio of light to quantity of gas consumed. The lights in the Exposition building were placed under the supervision of the Cincinnati Gas Company, and were personally inspected, before the public opening, by Gen. Hickenlooper, who, by-the-way, has taken a very lively interest in arranging for the illumination. As a result of that interest he has most beautifully illuminated the streets of the city, thereby contributing a very considerable addition to the list of attractions.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Personal.—Mr. William N. Milsted, who, as General Superintendent and Treasurer of the American Meter Company, is known and valued by the gas fraternity of this country as a man of genuine merit and sterling worth, took passage for Europe by steamer Arizona, on date of September 14th. He will remain abroad for some two months or more, and while the time consumed will be devoted to business aims and ends, no doubt the urbane gentleman will extract much pleasure and gain no little measure of relaxation from even the ordinary circumstances that attend upon foreign travel. Blessed with acuteness of perception and abounding in *bonne foi*, his journey cannot fail of success in encompassing the primal objects for which it is intended. We heartily wish him all things that go to make up a safe voyage and a prosperous visit, upon the termination of which we hold ourselves in readiness to be numbered among those who will voice the chorus, "Welcome home!"

Annual Meeting, Providence (R. I.) Gas Light Company.—When President Amos C. Barstow, at noon of Monday, September 6th, opened the proceedings consequent upon the annual meeting of the stockholders of the Providence Gas Light Company, he had the satisfaction of noting that the shareholders were represented in large numbers. In fact this attendance has always been a pleasing feature of the Providence Company's annual session, and we regret greatly that a like statement cannot be more often made in regard to like conclaves of similar business enterprises. However, if those financially interested do not care to pay attention to such "irksome details," perhaps it may be best to say nothing more about it, and therefore do we leave them to the "error of their ways." The annual report having been read—the document was brief, but filled with pith and point—and accepted, a ballot for directors, to govern during the ensuing year, was taken with the following result: Colonel Wm. Goddard headed the list, followed by the Hon. Amos C. Barstow, and Messrs. A. B. Slater, Royal C. Taft, Edward Pearce, Jesse Metcalf, Amos N. Beckwith, G. W. R. Matteson, and Lucien Sharpe. In the subsequent organization proceedings the Hon. A. C. Barstow was chosen to the Presidency; Col. Wm. Goddard was selected as Vice-President; and Mr. A. B. Slater was named to occupy the dual office of Treasurer and Secretary. A comparison of the foregoing names with those published in our columns a twelvemonth ago reveals no change in the executive management of the company, and its record of success during the fiscal year recently terminated furnishes sufficient reason for continuing in command those who have so ably and faithfully shaped its policy.

A Line or Two from Hudson, N Y.—Hudson, although it claims to possess a population of at least ten thousand inhabitants, and has a decided tendency to desire to be included in the list of live places, is nevertheless satisfied to light its streets exclusively with naphtha lamps. The contract now in force, which we think became binding in April of this year, provides

that the naphtha light purveyors are to receive $17.50 per annum per lamp, and under the arrangement are maintaining about 250 of their ill-smelling, smoke-producing "illuminators." The Hudson Gas Company offered to maintain gas lamps at an annual charge of $19 per post, but the Councilmanic wiseacres preferred to inflict the naphtha nuisance upon their fellow townsmen, and now "point with pride" to the fact that such a "prudent course" has resulted in the saving of just $375 per annum to the city treasury. Oh, yes; Hudson may be a "live place;" but it would seem as if its Councilmen derived a portion of their prudent resolves during brown studies indulged in during more or less prolonged visits to or rambles through Hudson's graveyards! Strange to say it is reported that the Hudson Gas Company experiences no trouble in disposing of its surplus coke product, which is retailed for domestic use at a charge of eight cents per bushel, although it is more than likely that the greater portion of the coke is taken up by a large firm of local manufacturers, who obtain their supply at a much lower figure than the one exacted from domestic users. Hudson's ambition will be more quickly attained—*i. e.*, in the matter of "liveness"—if its voters will select different councilmanic representatives.

And Still the Work Goes on.—Mr. Adam Weber, proprietor of the Manhattan Firebrick and Enameled Clay Retort Works, New York city, still keeps on with untiring energy, although he will even confess that sometimes the "pace grows rather hot." However, we are fain to admit, no matter how fast they "carry" him, that the finishing post records always reveal the fact of his having been present in due season at that important point. Among other orders now on his books we note the following: New regenerative furnaces for the Citizens Gas Light Company, Buffalo, N. Y.; same for Warren (Ohio) Gas Light Company, and at Catholic Protectory building, this State. The contract for furnishing all the fireclay materials for the new plant of the Municipal Gas Light Company, Albany, N. Y., has also been awarded him.

Cheaper Gas for Taunton, Mass.—Brother Leach, of Taunton, once more announces that his directors will take the bull by the horns, or more correctly speaking, will seek to put buttons on the aforesaid horns—does not the chronic growler like to hear himself bellow, and because of that propensity is he not like unto the bull?—by lowering gas rates. The new schedule is as follows:

To consumers using less than 125,000 cu. ft. per quarter..$1.65 per M.
" " over 125,000 " " .. 1.45 "

The announcement was made on date of September first, and the schedule takes effect from and after first proximo. We believe the Taunton gas folks lowered selling rates about a year ago, and if we mistake not the prices were then adjusted to $1.75 and $1.50 per thousand cubic feet, according to the above named allotments of quarterly consumption. Brother Leach, in his periods of brown study, evidently does not make his selection of a "thinking ground" agree with that which we surmise is chosen by the Hudson Councilmen.

Not to Make Gas.—Advices from Boston, Mass., convey the information that the Hallowell (Me.) Gas Light Company has changed ownership. The purchasers have decided not to manufacture gas on their own account, but have made a contract with the directors of the Augusta (Me.) Gas Light Company under which the latter will supply the needs of the former. The Hallowell folks are now finishing up the job of connecting the conduit lines. Hallowell is on the west bank of the Kennebec river, and is about two miles below Augusta. It is but a small place, having a population of less than 3,200, although not far from it are located important granite quarries. The real wonder is that this combination of the gas interests of the places named was not effected long since, and there can be no doubt but that the union will be alike profitable to Hallowell's gas suppliers and gas consumers.

The Butte City (Montana) Gas Works.—Over a year ago we were called upon to chronicle the formation of a gas company to operate in far-away Butte City, Montana; and, if the truth were honestly told, we did not think the organizers of the Company would be in any hurry to construct a plant. In fact it seemed as if a gas plant would find slim occupation in furnishing gas to the residents of a thinly-settled section in which the ring of the miner's pick overcame all other sounds. Having made this confession, we now propose to expiate our sin of doubt by furnishing some slight hint as to what the Butte gas folks have succeeded in doing, premising the "atonement" by adding that to Mr. N. L. Maher, who has been connected with the Butte City works in the capacity of Superintendent since February last, are we indebted for the particulars which have caused within us a change of heart. An eligible plot of land, in close proximity to the principal railway depot of the place, was secured, and substantial retort, purifying, and meter houses were at once put up. Suitable provision for coal and lime storage facilities was made; in fact no expense was spared to secure a first-class plant—one equipped with a sufficiency of condensing and scrubbing apparatus. Possibly the only defect is a lack of holder capacity; but that is quite excusable when one remembers that Butte City appears to have the remarkable characteristic of being able to "double itself up" (as to permanent residents) at yearly intervals. The works were started on gas making in September, 1885, and the station meter records the fact that 7,786,850 cubic feet had passed through it up to date of August 15, 1886. Over 150 consumers' names appear on the bill books of the Superintendent, and the end is not yet. To make our confession still more complete, Mr. Maher says that they have the material on the ground with which to double the present capacity of the "mining town gas works." One particularly interesting item given by the Superintendent is contained in the statement that he carbonizes Crested Butte coal—mined in Gunnison county, Colorado—from which a yield of 7 cubic feet to the pound is obtained. No figures as to illuminating value of the resultant gas, nor in regard to coke product either, accompany that statement, and we ask Mr. Maher if he will send on some further information concerning that wonderfully rich black diamond. Having thus made slight amend for our former underestimation of the Butte City gas field, we hope at some future period to say that its later growth has kept steady pace with its earlier strides.

Chpaper Gas for Rome, Ga.—The proprietors of the Rome Gas Light Company are to make an important concession in selling rates. The schedule will be made public in a few days.

An Item from Barnesville, Ohio.—The Barnesville gas men have about completed the extensions and repairs begun some weeks since. The holder, which was in a pretty bad state—it was suspended by means of an ordinary block and tackle, from 1st day of January to July 10th of present year—is now in good working order. New covers have been fitted to the purifying boxes; and a six-inch Connelly exhauster has been added to the plant. The Barnesville gas outlook is encouraging enough to warrant the prediction that the two present benches of threes will blossom out into benches of fives before the spring of '87 disappears from the muster roll of that year's seasons. Mr. Geo W. Trisler is in charge at Barnesville.

New Gas Company.—Some time during last August Messrs. E. W. Pike, of Chicago, Ills., W. L. Martendale, of Madison, Wis., and H. C. Cross, O. W. Waymire, and D. M. Davis, of Emporia, Kas., were granted a charter to organize and operate a combined gas and electric light company within the limits of Salina, Kansas. The capital stock is placed at $60,000. Salina is the capital seat of Saline county, Kansas, and is situated at a point on Smoky Hill River, about 47 miles west by south of Junction City. It is on the Kansas Pacific Railroad, and is noted for its salt springs and gypsum quarries. It has a population of about 3,500.

The Root Exhausters are in Great Favor.—The Messrs. Roots, of Connersville, Ind., report that the trade in exhausters is remarkably brisk. To prove the statement they have furnished us the following list of recent sales: One No. 6 exhauster to Chicago (Ills.) Gas Light and Coke Company; a No. 2 to Waukesha, Wis.; a No. 1 to Portage, Wis.; and a No. 1 to El Dorado, Kansas. All these instruments are in combination with engines on same bed plate, and are also equipped with governors. The Indianapolis (Ind.) Gas Light Company purchased a No. 4 exhauster and engine on same bed plate, also a governor, bye-pass valve, pipe fittings, etc. Messrs. Helme & McIlhenny, of Philadelphia, Pa., purchased a No. 3 exhauster which is intended for shipment to Mexico. The above list may be increased by mentioning the following orders now on Messrs. Roots' books: A No. 5 exhauster and engine, with governor, bye-pass, valves, and 16-inch pipe fittings, for the Memphis (Tenn.) Gas Light Company; a No. 4 exhauster, with equipment similar to that mentioned for Memphis, for the Peoples Gas Light Company, of Cleveland, Ohio; and a No. 2½ exhauster and engine, on one bed plate, with governor, 12-inch pipe fittings, bye-pass, and gas valves, for the Winona (Minn.) Gas Light Company. A pretty fair share of business, surely.

A Word or Two Concerning another St. Paul (Minn.) Gas Man.—Due credit should be given to Mr. E. I. Frost for the prominent part taken by him in directing the executive management of the St. Paul Gas Light Company. To his shrewdness and tact may be traced the fact that St. Paul's gas suppliers enjoy the good will of the community in which they operate, and his acknowledged ability may be accepted as certain evidence that that good will is not to be diverted in the future. In our last issue we had occasion to say that "money and skill are at the free command of the company's managers, and it is needless to add the money is expended and the skill is invoked," and between the course of Frost and White the financial and engineering ends and aims are sure to be properly achieved, and the best interests of the company thereby subserved. We believe the lists of betterments, heretofore mentioned in these columns as planned for the summer's campaign, are about completed, and accordingly the plant is now in shape

to answer successfully and easily to a million cubic feet per diem demand upon its resources. Colonel Clement A. White, who had satisfactorily completed the task of overseeing the construction of the new water works at Selma, Ala., was, on date of August 1st, elected to the position of superintending engineer of the St. Paul Company. We wish him good luck, and have no doubt that he will render a good account of his stewardship. To round these few lines out in the most satisfactory manner, or rather to prove that Ed. I. Frost is endowed with a plentitude of executive ability, even to the point of carrying on successfully those delicate and sympathetic negotiations, which are believed by some to exceed the harmonies of triumphant diplomacy, we may whisper adown the winds that, ere the golden and scarlet glories of the present autumn are rudely cast down by November's wailing blasts, he will serenely lead to Hymen's altar one of Minnesota's fairest daughters. We presume some of his New York friends may now understand why he was so fond of the West.

To Aid Commerce.—According to the daily newspaper reports of the proceedings of the National Board of Steam Navigation, held in this city, on the opening days of present month, at the Hoffman House, we learn that the question of electric lights in New York harbor was discussed. Much complaint was made against the employment of the light, which, it was claimed, made trouble for the pilots. The Hell Gate lights, it was asserted, made it almost impossible for a pilot to make his way, so deceptive was the nature of the illumination. The arcs on the Brooklyn Bridge, as also those at the Battery, were spoken of; but, on account of their greater elevation, the complaint in regard to them was not so strongly pressed as in the case first noted. As a result of the discussion it was agreed that the Executive Committee be instructed to memorialize the Secretary of the Treasury, or other proper authority, praying that screens be placed in front of the Hell Gate lights. In illustration of this the action of the Jersey City Ferry Company was cited. When the company put in electric lights in their New York and Jersey City stations the pilots found it impossible at night to steer correctly until large board screens had been placed in front of the centers of the arcs. Here is a request, made in the best possible faith, by men whose only motive is to protect and conserve the best commercial interests of the port of New York.

Killed by Electricity.—A special to the *Associated Press*, from Minneapolis, Minn., and dated September 3d, says: "Last night, Mr. Wm. H. Brockway, Superintendent of the Brush Electric Light Company, while making some repairs to an electric lamp, was killed. Orders had been issued to disconnect the circuit, but through a misunderstanding the current was turned on as usual at 6:30 P.M. The men who were with him say that just as Mr. Brockway touched the overhead wire with his nippers there was a slight flash. Mr. Brockway exclaimed, "Oh!" and fell to the floor. He died instantly." We might add the accident took place in the Nicolett House.

The Charleston (S. C.) Disaster.—Of course, it is entirely unnecessary that we should here dilate upon the terrible disaster that has befallen the people of Charleston, since the whole country, with the common impulse of humanity, has long since poured out its offering of sympathy, and backed that up with substantial aid for the relief of those so sadly stricken. While the fraternity can rejoice in the safety of Mr. Turner and his family, and will find great satisfaction in the knowledge that the Charleston gas works were not destroyed, it is nevertheless true great damage has been done to the property of the company. The chief difficulty experienced has been to keep up a sufficient pressure, owing to the numerous breaks occasioned in the conduits. This fact of itself is enough to prove the violence of the shock that almost overturned a prosperous city. Residents of the metropolis who experienced the vibrations of the earthquake of Aug. 10th, 1884, will recall that visitation with uneasy minds; but despite its apparent violence we fail to remember that any more than ordinary trouble was subsequently reported in connection with the gas conduits underneath our roadways. As our information goes many of the street lamps remained unextinguished during the worst period of the Charleston upheaval, and further that the supply of gas was at no time cut off. We do not state this positively; but think it to be the truth. In the meanwhile Mr. Turner has manfully set at work on the task of repairing the mains, and we hope it will not be many days before success will have rewarded his labors. We are glad to note that the gas men throughout the country frequently appear on the lists of subscribers to the Charleston relief fund.

A Later Despatch from "Retort."—Since the receipt of "Retort's" first collection of Western Notes, which will be found on page 172, a second enclosure contains the following: "Since prior time of writing, the Wichita (Kas.) Gas Light Company has been reorganized. Certain St. Louis (Mo.) capitalists have purchased a controlling interest in its stock, and they propose to at once put the plant in condition to meet the gas requirements of the city. The works will be remodeled and the street mains will be enlarged and extended."

Davis & Farnum Will Not Stop.—Fred. Davis reports that the tide sweeps right along, without any indication of an approaching ebb. Among the work now in hand we may say that they will erect at the South Station of the Providence (R. I.) Gas Light Company a handsome specimen of the A. C. Wood patent scrubber. It will consist of eight wrought iron sections, each of the latter to be 35 feet long by 4 feet wide by 1 foot high. At Haverhill (Mass.) contracts are being carried out which call for the erection of an elegant and commodious retort house. The structure is to have a width of 60 feet, and will be covered with an iron and slate roof. The blue prints of this work incline one to the belief that Haverhill's new retort house will be worth while journeying on to look at. The benches are to be fired by the Dieterich plan. Haverhill has also ordered a sinuous friction condenser, with a dimension of 16 feet in length by 4 feet wide by 22 feet high—calculated to pass 400,000 cubic feet each 24 hours. At Danvers, Mass., Messrs. Davis & Farnum are under contract to erect a new holder, but we have no particulars as to dimensions. At Vineland, N. J., they are making preparations to remodel and enlarge the existing gas plant. A month ago we predicted that Mr. Farnum would likely make it very warm for Mr. or Col. Jno. D. Watson, ex-lessee of the Vineland gas works; and the sequel looks like it. In fact, as we understand it, the Colonel partly enjoys freedom of personal action simply because he succeeded in inducing some friend of his to sign a bail bond.

A Line or Two from Danville, Ills.—The owners of the Danville Gas Light Company do not appear to be greatly alarmed at the operations of the local electric lighting company, notwithstanding that the latter now light the streets and have some customers in the business portion of the city. No doubt this apathy may be explained on the ground that the city grows rapidly, and bids fair to outstrip the promises made by its most enthusiastic residents; but to whatever cause the apathy may be traced, there is no disputing the assertion that the Danville gas men are now changing their works from a six to a ten-inch basis. The purifying plant has been renewed in every detail—the boxes are 10 feet by 14 feet—and includes in its features adequate condensing and scrubbing apparatus. The distribution system has received an addition of 5,000 feet of pipe—2,000 feet of 12-inch and 3,000 feet of 6-inch being the allotment made. Selling rates at Danville are as follows: $2 per thousand on a consumption of less than 10,000 cu. ft. per month, with 10 per cent. off on quantities in excess of the stated volume. A local coal—its outcroppings can be easily traced at various points on the bluffs of the Vermillion river, on which stream Danville is located—is exclusively carbonized, and a 17-candle gas is obtained therefrom. Mr. J. G. English is President of the Company.

The American Gas Improvement Company.—A correspondent informs us that the American Gas Improvement Company, with offices at 6234 Penn avenue, Pittsburgh, Pa., is the sole owner of the patents granted to Messrs. John McKay, of Titusville, and J. M. Critchlow, of Beaver Falls, Pa., who have devised, it is said, a most satisfactory plan for the conversion of natural gas (chiefly by decomposition and enrichment) into a stable and valuable illuminating agent. Beaver Falls and Brighton, Pa., through a period of 19 months, have employed this process, and it is said Titusville, Pa., has operated under it for over a year. Plants are now in course of construction at Meadville and Warren, Pa., and also at points in Ohio and New York. The managers of the home company are Messrs. W. H. Denniston, Pittsburgh; W. B. Roberts, E. T. Roberts, and John McKay, Titusville; and J. M. Critchlow, Beaver Falls.

A Waif from Toronto, Canada.—At a meeting of the Fire and Gas Committee of Toronto's Aldermanic Board (held August 25) the chief of the Fire Department reported that during the present year 31 gas lamps had been discontinued on account of the erection of electric lights, and 28 new gas lamps had been erected during the same period.

Cost of Street Lighting at Seattle, Washington Ter.—Under the contract now in force between the gas company and the municipality, the former is paid $4.50 per month for each street lamp maintained. In addition the company receives $1 per lamp per month for lighting and extinguishing. The contract, however, has but a short time to run; and in fact the company has already submitted a bid by which it agrees to supply each lamp with gas at a monthly charge of $2. The Seattle electric light company offers its incandescent lamps to the city for the sum of $3 each per month, or will swing 2,000-candle power arcs over the street crossings if it is guaranteed the sum of $9.70 each per month.

No Electric Lights for Paupers.—The electricians "out Detroit way" wanted to convince the Board of County Superintendents that the inmates of the County House ought to be electrically illuminated; but as it was shown that the plant alone would cost $4,000, "not saying a word" about the salary of an engineer, the Board decided to veto the scheme, or, as our informant puts it, "decided they would not make any outlay for frills and

scallops." It was finally determined to put in a pneumatic gas machine, controlled by Chicago folks, who, through the local agent, agreed to do the work for the sum of $2,525. The citizens of Detroit might better ask the County Board to take charge of the public lighting of that city, for, bad and all as gasoline-fed street lamps undoubtedly are, they will give better satisfaction than the present style of electrical illumination there followed affords, without referring to the saving which would be effected.

Acquiring More Property.—On September 9 the Managers of the Troy Fuel Gas Company purchased the property known as the Hannibal Green spring factory, together with adjoining space, for the sum of $30,000. They propose to erect a plant capable of sending out anywhere from one to five million cu. ft. of heating gas each 24 hours. They claim to be now sending out 50,000 cu. ft. per day.

A Royal Time.—Mr. Chas. S. Waldo, of Boston, Mass., must be held responsible for having given, on date of Sept. 4, a rare treat to as jolly a party of gas men as ever "sailed the seas over" in concert. In response to his invitation the guests departed from Commercial Wharf, Boston, on board the tug Wm. H. Clarke, at 9 A.M. of the 4th inst., and in due time witnessed, off Marblehead, the annual open regatta of the Beverly Yacht Club. It goes without saying that the trip was most enjoyable, for Bro. Waldo is a royal entertainer, and the atmospheric conditions were simply perfect. The regatta, as Mr. Waldo promised in his letter of invitation, afforded a good race and a beautiful sight, for a stiff northwest wind insured a "wet sheet and a flowing sea." Among those present were Messrs. Harbison, Cabot, Humphreys, Stiness, Rollins, Prichard, Davis, Leach, Andrew, Cushing—but we might just as well ask our readers to look over the list of members of the Guild of Gas Managers. Brother W. H. Down, of New city, was also on the tug's list.

Comparative Value of Gas and Oil for Street Lighting.—Mr. G. Anderson, Westminster, on the evening of August 17, made the following experiment, a report of which, in the shape of a letter from the experimenter, we find in the London *Journal*.

"I drove first through the Putney district and along one side of Wimbledon Common till I came to the Wimbledon oil lamps. The gas lamps were all lighted; the first four of the oil lamps were not lighted. The oil lamps have an intensely dark spot of about 3 yards square under each lamp. I took with me to-day's *Times*, and paced the distance from each post at which I could just read the letter of Wilfrid Lawson on the 11th page. The night, being free from wind or rain, was the most favorable for oil lamps; and the lamps were all burning satisfactorily, as these lamps do when in good condition. The oil lamps gave much less light than the gas lamps, as is proved by the following comparison of the illuminating power of nine oil lamps in the Wimbledon district and nine gas lamps in the Putney district:

"Number of paces from the lamp post at which a newspaper could be read—

"Oil..... 2, 4, 4, 3, 3¼, 3, 3½, 2, 4 = 29¼; average, 3¼.
Gas..... 7, 6, 6½, 6, 6½, 7, 6½, 5½, 6½ = 57; " 6⅓."

He thereupon figured it out that as the square illuminated by the oil lamps is to the square illuminated by the gas lamps as 1 : 2.84, it follows that the gas lamps give over 2¾ times as much light as the oil lamps.

Correspondence

[The Journal is not responsible for the opinions expressed by correspondents.]

Mr. Lansden and not the Journal Can best Answer for the Results Secured at the St. Louis (Mo.) Gas Works.

Georgetown, D. C., August 31, 1886.

To the Editor American Gas Light Journal:

In a recent issue of your valuable paper, date of Aug. 16, page 104, I read, in your report of the proceedings at the Ninth Annual Meeting of the Western Gas Association, the discussion which took place in regard to the question, "What is the greatest yield of gas to be obtained per pound of Youghiogheny coal, without any enricher, the product to have an illuminating value of 16 candles, and to be registered at 60° F." At least two answers were given to the portion of the query relating to the yield about which I will here raise no question; but an answer was also made to the last section of the query (in regard to candle power), which, I think, at least in so far as it appeared in print, is misleading, and should be either *explained* or *eliminated*. A Mr. Lansden is reported to have said, "He (Mr. Lansden), on an average of 11 days, when a new supply of Youghiogheny had been carbonized, had obtained a yield of 5.25 cubic feet to the pound, and the gas showed, according to his records, an illuminating value of 17.65 candles." He also says he has a Bunsen photometer at his works, and we may fairly infer that the quality of his gas is measured by that instrument.

Mr. Lansden, no doubt perceiving that some of those present did not exactly or closely comprehend his statement, followed his first utterance up with the explanation that he worked with a vacuum of two inches on his hydraulic main, and also carried a tar seal of 2½ to 3 inches to his dip-pipes, thus causing his gas to bubble up through that number of inches of tar, and so become enriched by taking up all the light oils contained in the tar. In fact the gas succeeded so well in absorbing the aforesaid light oils that his tar purchasers found an entire absence of the lighter oils in the tar delivered them.

The foregoing statements are simply marvelous to the ordinary gas man. First, I will say that for 25 years the best inventive geniuses in the ranks of the gas fraternity have been "on the stretch" for devices best suited to afford relief from pressure on the retorts caused by the gas being unduly confined in them through the inevitable dip-pipe and tar seal in the hydraulic main—a pressure not, however, of *three inches*, but more often of not more than *one inch*. Now, after the labors of over a quarter of a century, and the expenditure of hundreds of thousands of dollars, can it be that all was in vain—indeed worse than vain! Some of us, however, will require greater evidence in support of the "in vain theory" than that afforded by the mere *ipse dixit* of Mr. Lansden. Again, Mr. Lansden's premises are at variance with sound principles of reason, as attested by the practical experience of all the gas makers of to-day—Mr. Lansden, of course, excepted. That is to say, our experience has taught us that to unduly confine the gas in the retort leads, without a single exception, to a deposit of carbon which adheres to the crown and sides of the retorts, thus causing a twofold loss—at the burner tip, where it is needed to furnish light, and a great diminution in the carbonizing capacity of the retorts. Yet again is this deposit a source of loss, as both time and fuel must be expended in removing it from the retorts—an operation that must be performed at least every sixty days, or oftener.

More fallacious still is Mr. Lansden's assertion that by causing his gas to bubble up through three inches of tar, he secures an illuminating value of 17.65 candles, and in consequence of that process obtains a tar almost entirely stripped of the lighter oils usually found in coal gas tar. The fallacy must be evident to every coal gas manufacturer, and they will be inclined to believe that the hydrocarbons contained in the gas, when it was first liberated from the coal, have all been deposited in Mr. Lansden's retorts, and thus not only was his gas made poor, but his tar as well was robbed of its natural ingredients.

The question may be asked why I put such stress on Mr. Lansden's particular report of yield and candle power; or in what way does it affect me or my works? I answer, seriously, in many ways; and as I am affected so may it be with others situated like me. I have been serving a small company ever since I was appointed to its superintendency—on Feb. 9, 1854—or for over 32 consecutive years. Gas associations are modern organizations in our country, and as I have plodded along without any personal connection with such institutions, I am led to believe that the directors of my company have not deemed it to be important enough to invest the amount of money necessary to maintain or send a representative to such conventions. For that reason I have (doubtless it is so with others) to content myself with subscribing to the Journal, which publishes the proceedings of such associations. I have been a subscriber to and a constant reader of the American Gas Light Journal for quite a number of years, and now, with its numbers on file in the office of the Georgetown Gas Light Company for that lengthy period, what is the inference to be drawn by my superior officers? Will they not think it must be a reliable publication, else I would not have patronized it so long; but when my President reads and subsequently quotes an utterance promulgated at a regular meeting of a gas light association, and reproduced in a reliable publication, that a Mr. Lansden, in the West, produces nearly 12,000 cubic feet of 17.65-candle power gas to a ton of coal, while I (out of the same coal, in name at least) can only obtain an average yield of 10,600 cubic feet of less than 13-candle power gas, is it not likely that he will commence to question my management—and has he not a right to do so from the evidence before him?

A congressional committee has the right to send for "experts," and because of them and their testimony may malign the honest efforts of those who are being "investigated." Through interested witnesses and loud sounding phrases the investigators may succeed in their ways—"which are dark"—but no one versed in their tricks will think seriously about it. The whole scheme was followed out merely for effect, and after the conflicting interests are subserved, the "investigation" and the investigators are perhaps never again heard of. But it is not so with the proceedings of gas associations. These are composed of men who pay their money to become privileged participants in the benefits of the organization, and no doubt are seeking after the truth. Truth, and not fiction, is what is wanted. Facts should be sought for and not philosophy. Theory and experience, as they go hand-in-hand, will surely lead to valuable practical results; but if these principles are perverted so that we find that which is promulgated to be unreliable, confidence will soon be destroyed, and incongruity will become the ruling feature in all the formulations offered for publication.

Yours, etc., J. D. Cathell, Supt.

THE AMERICAN
GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—JOS. R. THOMAS, C.E
Manager—C. E. SANDERSON.

PUBLISHED ON THE 2ND AND 16TH OF EACH MONTH
At No. 42 Pine Street, New York.

This is a recognized official organ of—
LIGHT, HEAT, STEAM, WATER-SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE.

TERMS

SUBSCRIPTION—Three Dollars per annum, in advance.

AGENTS

NEW YORK—AMERICAN NEWS Co. 39 and 41 Chambers St.
BOSTON—S. M. PETTENGILL & Co., 6 State Street.
PHILADELPHIA—PRATT & Co., Corner 9th and Arch Streets.
England—C. W. HASTINGS, 22 Buckingham St., London, W C.
Germany—B. WESTERMANN & Co., of New York

THURSDAY, SEPTEMBER 16, 1886.

The Market for Gas Securities.

The market for city gas shares during fortnight developed no unusual feature, although a weak tone yet pervades the transactions. Consolidated see-sawed somewhat, and sellers outnumbered buyers. Equitable was noticeably weak; in fact there was little from which holders could extract comfort in their scanning of quotations. At time of writing (noon, Sept. 14) Consolidated is quoted at 79¾ to 80, which shows that the disturbing conditions have been discounted. Brooklyn shares are still woefully weak, and those on the inside predict the coming winter will furnish a clue to a weakness in prices that on sound financial reasoning is simply unaccountable. We retract our advice of a fortnight ago in respect to the wisdom of a purchase of Brooklyn gas shares, not because these stocks, at present selling prices of gas, will not return an income to holders, but because the Albany solons, having killed the gold-bearing gas goose of New York city, must hunt for a similar bird in a likely locality. Laclede, of St. Louis, Mo., has advanced to 110, and beyond a doubt it will reach 125 before 1st day of January.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.

16 WALL ST., NEW YORK CITY.

SEPTEMBER 16.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	78	78¼
Central	440,000	50	—	—
" Scrip	220,000	—	47	57
Equitable	2,000,000	100	108	112
" New Stock			150	155
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	113	—
Mutual	3,500,000	100	101	105
" Bonds	1,500,000	1000	104	107
Municipal, Bonds	750,000		—	—
Northern	125,000	50	—	—
" Scrip	108,000			
Yonkers		50	51	55
Richmond Co., S. I.	300,000	50	50	—
" Bonds	40,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	110	115
Citizens	1,200,000	20	68	72
" S. F. Bonds	320,000	1000	—	105
Fulton Municipal	3,000,000	100	150	151
" Bonds	300,000		—	105
Peoples	1,000,000	10	65	72
" Bonds	290,000	—	—	103
" "	250,000	—	—	102
Metropolitan	1,000,000	100	79	82
Nassau	1,000,000	25	110	113
" Ctfs	700,000	1000	—	101
Williamsburgh	1,000,000	50	130	136
" Bonds	1,000,000	—	—	111
Out of Town Gas Companies.				
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	130	135
" " Bonds.	124,000	—	105	110
Chicago Gas Co., Ills	5,000,0000	25	128	135
Peoples G. L. & C. Co., Chicago, Ills	3,000,000		8	12
Cincinnati G. & C. Co.			190	194
Consolidated, Balt.	6,000,000	100	51¾	—
" Bonds	3,600,000		107	107½
Chesapeake, Balt	1,500,000	100	—	70
"	1,000,000		100	102
Central, S. F., Cal.			70	72
Capital, Sacramento, Cal.			54	56
Hartford, Conn	750,000	25	140	142
Jersey City	750,000	20	160	165
Laclede, St. Louis, Mo.	1,600,000	100	110	117
Louisville, Ky	1,500,000	50	118	121
Little Falls, N. Y.	50,000	100	95	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	209	215
New Haven, Conn		25	190	195
Oakland, Cal			35	35½
Peoples, Jersey City		—	25	30
" " Bonds			—	—
Paterson, N. J		25	90	—
Rochester, N. Y		50	75	80
St. Louis, Missouri	600,000	50	—	475
San Francisco Gas Co. San Francisco, Cal.	10,000,000	100	59	60
Memphis (Tenn.) Gas	750,000	100	80	82
" Bonds.	240,000	100	103	—
Washington, D. C	2,000,000	20	190	—
Wilmington, Del		50	205	215
Havana (Cuba) Gas Co.	3,000,000	100	18	20
" Bonds	550,000		102	—

Advertisers Index.

GAS ENGINEERS. Page

Jos. R. Thomas, New York City ... 186
Wm. Henry White, New York City ... 186
Wm. Farmer, New York City ... 186

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd, New York City ... 189
T. F. Rowland, Greenpoint, L. I ... 189
Deily & Fowler, Phila., Pa ... 189
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 189
Stacey Mfg. Co., Cincinnati, Ohio ... 189
Bartlett, Hayward & Co., Baltimore, Md ... 189
Morris, Tasker & Co., Limited, Phila., Pa ... 188
Davis & Farnum Mfg. Co., Waltham, Mass ... 158
Tanner & Delaney Engine Co, Richmond, Va ... 188
R. D. Wood & Co., Phila., Pa ... 188
Southwark Foundry and Machine Co., Philadelphia, Pa ... 188

PROCESSES.

National Gas Light and Fuel Co., Chicago, Ills ... 190

GAS AND WATER PIPES.

Gloucester Iron Works, Phila., Pa ... 186
Warren Foundry and Machine Co., Phillipsburgh, N. J ... 186
Mellert Foundry and Machine Co., Reading, Pa ... 186
Cincinnati and Newport Iron and Pipe Co., Newport, Ky ... 186
John Fox, New York City ... 186
Ohio Pipe Co., Columbus, Ohio ... 186
Pancoast & Rogers, New York City ... 186
M. J. Drummond, New York City ... 186

GAS ENGINES.

Schleicher, Schumm & Co., Phila., Pa ... 194
Clerk Gas Engine Co, Phila., Pa ... 180

RETORTS AND FIRE BRICK.

J. H. Gautier & Co., Jersey City, N. J ... 184
B. Kreischer & Sons, New York City ... 184
Adam Weber, New York City ... 184
Laclede Fire Brick Works, St. Louis, Mo ... 184
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y ... 184
Borgner & O'Brien, Phila., Pa ... 184
James Gardner, jr., Pittsburgh, Pa ... 184
Henry Maurer, New York city ... 184
Chicago Retort and Fire Brick Works, Chicago, Ills ... 184
Baltimore Retort and Fire Brick Co., Baltimore ... 184
Standard Gas Retort and Fire Brick Co., Ironton, Ohio ... 184
Oakhill Gas Retort and Fire Brick Co., St. Louis, Mo ... 184
Evens & Howard, St. Louis, Mo ... 185
Cincinnati Gas Retort and Fire Brick Works, Cincinnati, O. 185
Emil Lenz, New York City ... 185

SCRUBBERS AND CONDENSERS.

G. Shepard Page, New York City ... 187

REGENERATIVE FURNACES.

Adam Weber, New York City ... 182
Bartlett, Hayward & Co., Baltimore, Md ... 182

GAS GOVERNORS.

Connelly & Co., New York City ... 181
T. C. Hopper, Phila., Pa ... 182

CEMENTS.

C. L. Gerould, Manchester, N. H ... 178
Howard Fleming, New York City ... 178

GAS ENRICHERS.

Forest City Naptha Co., Cleveland, Ohio ... 178

GAS METERS.

Harris, Griffin & Co., Phila., Pa ... 192
American Meter Co., New York and Philadelphia ... 193
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa ... 193
Helme & McIlhenny, Phila., Pa ... 193
Maryland Meter and Mfg. Co., Baltimore, Md ... 192
D. McDonald & Co. Albany, N. Y ... 193
Nathaniel Tufts, Boston, Mass ... 192

EXHAUSTERS.

P. H. & F. M. Roots, Connersville, Ind ... 185
Smith & Sayre Manufacturing Co., New York City ... 188
Wilbraham Bros., Philadelphia, Pa ... 190
Connelly & Co., New York City ... 182

GAS COALS.

Penn Gas Coal Co., Phila., Pa ... 191
Perkins & Co., New York City ... 190
Newburgh Orrel Coal Co., Baltimore Md ... 191
Despard Coal Co., Baltimore, Md ... 191
Chesapeake and Ohio R.R. Coal Agency, N. Y. City ... 191
Westmoreland Coal Company, Phila., Pa ... 191
Monongahela & Peters Creek Gas Coal Co., Pittsburgh, Pa ... 191

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y ... 182
John McLean, New York City ... 182
Fairbanks & Co., New York City ... 182

GAS LAMPS.

The Siemens-Lungren Co., Philadelphia, Pa ... 187
G. Shepard Page, New York City ... 146
Albo-Carbon Light Co., Newark, N. J ... 179
Crystal Carbon Light Co., Phila., Pa ... 178

PURIFIER SCREENS.

John Cabot, New York City ... 178

GAS STOVES.

American Meter Co., New York and Philadelphia ... 183
The Goodwin Gas Stove and Meter Co., Phila. Pa ... 162

STREET LAMPS.

J. G. Miner, Morrisania, New York City ... 178
Bartlett Street Lamp Mf'g Co., New York City ... 185

BURNERS.

G. Gefroter, Phila., Pa ... 177
G. Taylor, New York City ... 177

PURIFYING MATERIAL.

Connelly & Co., New York City 85

STEAM BLOWER FOR BURNING BREESE.

H. E. Parson, New York City 182

GAS FIXTURES.

Mitchell, Vance & Co., New York City 178

STEAM PUMPS.

A. S. Cameron Steam Pump Works, N. Y. City 185

STEAM ENGINES.

Westinghouse Machine Co., Pittsburgh, Pa 191

COKE CRUSHER.

C. M. Keller, Columbus, Ind 177
B. J. Allen, Newark, New Jersey 177

GAS BAGS.

Peerless Manufacturing Company, New York City 178

COAL HANDLING MACHINERY.

C. W. Hunt Company, New York City 178

BOOKS.

Gas as a Source of Light, Heat and Power 180
Goodwin's Directory of Gas Light Companies 180
The Chemist's Assistant 186
King's Treatise 193
Scientific Books 192
Management of Small Gas Works 186
Newbigging's Gas Manager's Handbook 184
Gas vs. Electricity 177

A SACRIFICE!

THE SIEMENS LIGHTING CO., No. 566 FOURTH AVENUE, LOUISVILLE, KY., are offering a stock of

SIEMENS REGENERATIVE GAS LAMPS

AT TWENTY-FIVE PER CENT. UNDER FACTORY COST, TO CLOSE OUT THE BUSINESS.

Situation Wanted

AS SUPERINTENDENT OF GAS WORKS.

Can come well recommended as to character and ability. Address "GAS SUPERINTENDENT," Care this Journal.

65-4

FOR SALE,

One Multitubular Condenser and By-Pass.

One Washer and By-Pass.

Hydraulic Mains and Bench Castings for Two Benches of Fives.

The above made for 8-inch connections.

Also, Five Eight-Inch Valves.

THE DERBY GAS COMPANY, BIRMINGHAM, CONN.

Superintendent's Position Desired

By a practical man of twenty-five years' experience in the manufacture and distribution of coal and water gas. Satisfactory references given. Address "ENGINEER," care this Office.

646-tf

FOR SALE—A BARGAIN.

One Set of Four Purifiers, with cast iron boxes. Size of boxes, 10x12 ft., with 12 in. connections and dry center seal. Also, **Four Cylinder Condensers** and **One Washer. One 10 H.P. Engine,** and **One 40 H.P. Boiler. Shafting, Pulleys, etc.** For particulars, address MUNICIPAL GAS CO., ALBANY, N. Y.

652-4

SITUATION WANTED

As Superintendent of Gas Works.

Has filled the position of engineer and superintendent of gas works for eight years. Understands the manufacture and distribution of gas, laying mains and services, the fixture and fitting business, and keeping accounts. Good references given.

Or would prefer to lease a works in a good city or town of 6,000 or 10,000 inhabitants, and would endeavor to advance th interests of the stockholders.

Address GEO. M. McCONAUGHEY, Care Austin Gas Lt. and Coal Co., Austin, Texas.

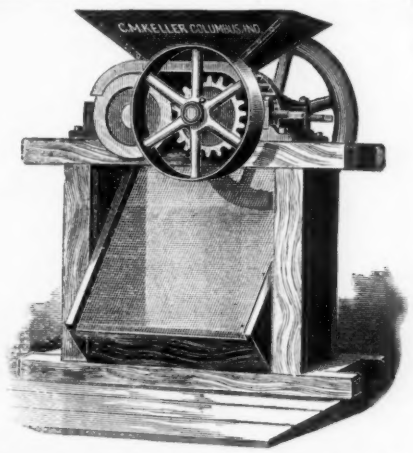
GAS COMPANIES, ATTENTION!

Increase the demand for Coke by using the

Star Coke Breaker.

SIMPLE, CHEAP, DURABLE. EASILY SHARPENED BY ANY BLACKSMITH.

B. J. ALLEN, Newark Gas Co., Newark, N.J.



Keller's Adjustable Coke Crusher.

SIMPLE, STRONG, AND DURABLE.

C. M. Keller, Sec. & Supt. Gas Lt. & Coke Co. Columbus, Ind.

Correspondence Solicited.

Notice to Gas Companies.

We desire to inform you that letters patent of the United States No. 345,368, applied for on November 21, 1885, were issued to us on July 13, 1886, for an improvement in Automatic Gas Governors, which improvement is set forth in the claim of said patent as follows, viz.:

"The combination of an automatic gas governor so constructed as to automatically increase or diminish the pressure at its outlet in proportion to the volume of gas passing through it, and an adjustable valve so constructed and arranged as to be capable of adjustment to pass different volumes of gas without changing the length of stroke or travel, substantially as and for the purpose specified."

We desire to notify you that we consider that any automatic gas governor having such an adjustable valve is covered by the said patent, and that all automatic governors containing such valves not made by us are infringements of our said patent. We give this notice that all persons may be informed of our claim, so that no one may ignorantly infringe upon our rights.

Very respectfully,

T. E. & J. S. CONNELLY,
Of CONNELLY & CO., LIMITED.

Taylor's AUTOMATIC GAS CHECK.

Pat. Sept., 1885. Just the thing for street lamps. No moving parts; only the gas moves, and checks itself by opposing currents; cannot get out of order or wear out; the cheapest and best of all governors. Samples, by mail, 10 cents. Send for circular.

G. TAYLOR, 60 Duane st., N. Y.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,
248 N. 8th Street, Phila., Pa.

GAS vs. ELECTRIC LIGHT.

We would invite attention to the able and exhaustive argument of General A. Hickenlooper, President of the Cincinnati Gas Light and Coke Company, contained in a handsome pamphlet of 96 pages, entitled

"EDISON'S INCANDESCENT ELECTRIC LIGHTS FOR STREET ILLUMINATION. REPORT OF AN ARGUMENT DELIVERED BY A. HICKENLOOPER BEFORE THE COMMITTEE ON LIGHT, MUNICIPAL COUNCIL, CITY OF CINCINNATI, JULY 22, 1886."

This is a subject of special interest to all Gas Light Companies.

Prices.

50 copies	$12.50	250 copies	$50.00
100 copies	22.50	500 copies	87.50

A sample copy will be sent by mail on receipt of 50 cts.

A. M. CALLENDER, & CO., 42 PINE ST., N. Y. CITY

TO ALL WHOM IT MAY CONCERN.

Notice is hereby given that a suit is now pending in the U. S. Circuit Court for the Northern District of Illinois against the Chicago Gas Apparatus Manufacturing Company and Newman A. Ransom, for infringing our rights under Letters Patent of the United States No. 247,925, dated October 4th, 1881, and No. 333,862, dated January 5th, 1886; and that a similar suit for like infringement has been instituted against W. S. Horry (trading as the Crystal Carbon Light Company), Arthur Kitson (trading as Kitson & Co.), and others, in the U. S. Circuit Court for the Eastern District of Pennsylvania. All persons in anywise infringing upon our rights under said Letters Patent will be prosecuted by us upon our obtaining proof of such infringement.

WALTER J. KIDD, General Manager.

THE ALBO-CARBON LIGHT COMPANY, - - NEWARK, N. J.

SOLE MANUFACTURERS FOR THE UNITED STATES.

TRADE MARK.

THE CRYSTAL CARBON LIGHT!

SELF-LIGHTING! SELF-REGULATING!

The Latest and Most Improved Carbon Light!

This Gas Burner, which is in reality an enriching gas machine, increases the illuminating power of ordinary coal or water gas to a point where it is comparable only to the dazzling brilliancy of the electric arc. Our new "Carboncrystal" (see below) has been prepared specially for this light, and is better adapted to it and purer than anything ever before used for this purpose. Under our newly introduced system of filling vessels *no attention whatever* is required to our lights on the part of the consumer. The actual efficiency of our new burner is between 8 and 9 candle power per cubic foot. This efficiency is constant in our smallest and largest clusters. We are aware that several manufacturers advertise as much as 13 candle power per foot. We make no such misleading statements as these, but still claim the highest possible efficiency, and declare, without fear of intelligent contradiction, that our system of lighting is more generally practical than any other improved system.

CARBONCRYSTAL.

(Trade Mark.)

A new and superior preparation for enriching gas used in conjunction with Crystal Carbon or Albo-Carbon gas lights. The preparation is cleaner and better adapted for filling burner vessels than any hitherto produced. Guaranteed to be chemically pure. Supplied in cans from 10 pounds up.

CRYSTAL CARBON LIGHT CO.,

Main Office, 1018 Chestnut Street, Philadelphia, Pa.

AGENCIES: Philadelphia, Pa. · Kansas City, Mo. · Reading, Pa. · Providence, R. I. · Baltimore, Md. · Memphis, Tenn. · Cedar Rapids, Iowa. · Omaha, Neb. · Minneapolis, Minn. · San Francisco, Cal. · St. Louis, Mo.

THE GLOBE STREET LAMP.

MINER'S PATENT STREET LAMPS.

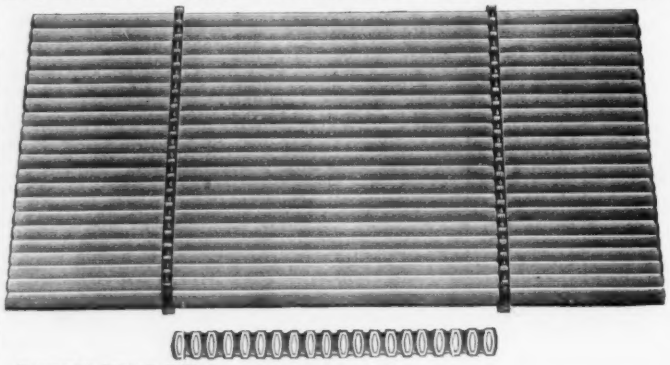
Are adapted for use of Streets, Parks, Depots, Ferries, & Private Grounds.

WITH POSTS OR BRACKETS.

Jacob G. Miner,

No. 823 Eagle Ave., New York N. Y.

CHURCH'S REVERSIBLE SCREEN FOR GAS PURIFIERS



PATENTED JULY 9, 1878.

Very Durable

Easily Repaired.

Oval Slats, with Malleable Iron Cross Bars.

Apply to

JOHN CABOT,

306 to 310 11th Av., N. Y.

References in all parts of the country. Send for circular and list of companies who now have the Screen in use.

GIBBS PORTLAND CEMENT

Is guaranteed to be the finest English brand, and unsurpassed by any grade imported for making concrete and setting masonry.

Extract of Paper, with tests, read before the American Society of Civil Engineers, sent on application.

HOWARD FLEMING,

Sole Agent for U. S.,

23 Liberty St., New York.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement for patching retorts, putting on mouthpieces, and making up all bench-work joints. This Cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick. For recommendations and price list address

C. L. GEROULD,

Manchester, N. H.

HOWARD FLEMING,

23 Liberty St., New York.

IMPORTER of

"BRIDGEND" "DINAS"

Silica FIRE Bricks

FOR COKE OVENS AND GAS WORKS.

PORTLAND AND ROMAN CEMENTS.

Correspondence Invited. Lowest Prices.

O. J. BENHAM, President. C. M. HIGGINS, Secretary. L. H. SEVERANCE, Treasurer.

The Forest City Naptha Co.,

REFINERS OF

Red Crown Brand

NAPTHA AND GASOLINES.

ALSO MANUFACTURERS OF

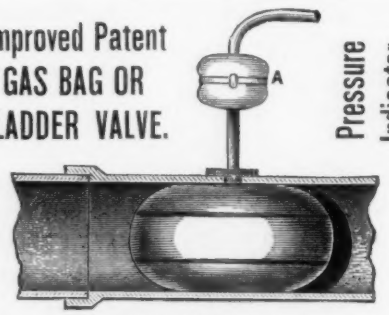
A Special Grade of Naptha for Gas Companies

FOR ENRICHING COAL GAS.

Correspondence solicited.

No. 43 Euclid Avenue, Cleveland, Ohio.

Improved Patent GAS BAG OR BLADDER VALVE.



MANUFACTURED BY

PEERLESS MFG. CO., 34 Murray St., N.Y.

MITCHELL, VANCE & CO.,

MANUFACTURERS OF

Chandeliers

and every description of

GAS FIXTURES.

Also manufacturers of Fine Gilt Bronzes and Marble Clocks, warranted best time-keepers. Mantel Ornaments, etc.

Salesrooms, 836 Broadway, N. Y.

Special Designs furnished for Gas Fixtures for Churches, Public Halls, Lodges, etc.

C. W. HUNT CO.,

No. 111 Broadway, N. Y. City.

MANUFACTURERS OF

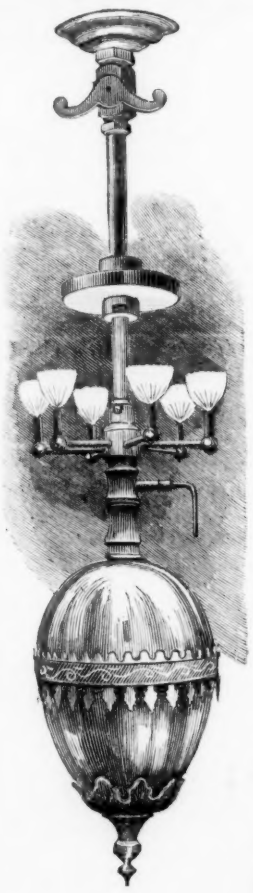
Coal Handling Machinery,

AUTOMATIC RAILWAY, HOISTING ELEVATOR, CABLE RAILWAY, STEAM SHOVEL, HOISTING ENGINES, COAL TUBS, COAL & COKE CARS.

Plans and Specifications made for the

Erection of Coal Storage Buildings

Send for a Descriptive Pamphlet.



THE ALBO-CARBON LIGHT.

This most successful of all methods of enriching gas is based on the use of heated gas to vaporize a solid hydrocarbon, thus

COMBINING THE ADVANTAGES OF PREHEATING AND CARBURETTING.

The incoming gas passes over an extended heating surface (heated by means of the illuminating flames), and is raised to the temperature necessary to vaporize the carburetting material, which is a white, crystaline solid prepared from coal tar.

Two Seasons of Practical Use in all parts of the Country have amply demonstrated that the Albo-Carbon Light stands unrivaled for

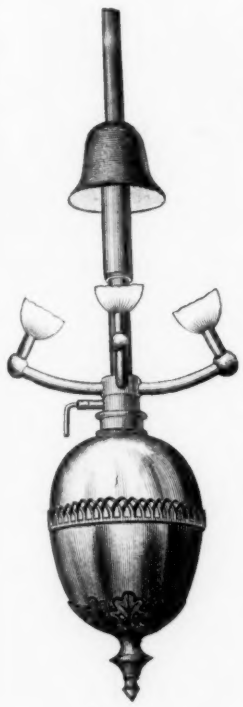
ECONOMY, BRILLIANCY, EFFICIENCY.

Gas Companies are Finding this System Superior to All Others

in enabling them to meet competition, as its adaptability to various requirements makes it equally as desirable to replace a KEROSENE LAMP, an INCANDESCENT LIGHT, or an ARC LIGHT.

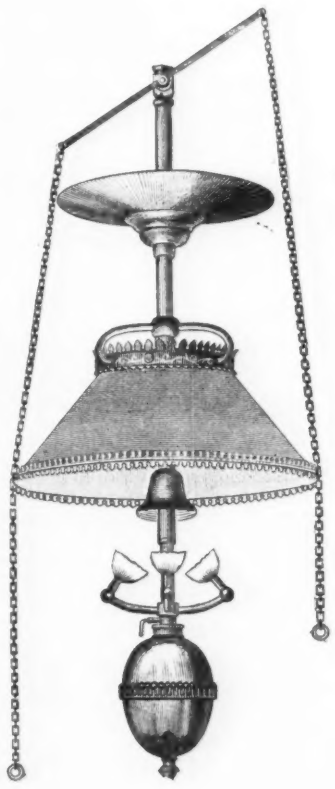
Our Apparatus are made in all Sizes, from 1 to 48 Lights (25 to 1,500 C. P.)

To enable Gas Companies to still more successfully meet this competition and to offer to the public still cheaper forms of our lights, we have added



New and Attractive Designs at Low Prices.

Send for Illustrated Catalogue and New Price List.



NOTICE.

Suits are pending in the U. S. Circuit Courts in Illinois and Pennsylvania against various persons for infringement of our Letters Patent No. 247,925, dated Oct. 4, 1881, and No. 333,862, dated Jan. 5, 1886. All persons are cautioned against manufacturing, selling, or using any apparatus or material which infringes our Patents. We intend to commence suits against all parties infringing Patents owned by us.

The Albo-Carbon Light Co.,

NEWARK, N. J.,

Sole Manufacturers for the United States.

GAS ENGINES. GAS ENGINES. BOOKS.

THE CLERK GAS ENGINE CO.,

Main Office, 1012, 1014, 1016, 1018 Filbert St., Philadelphia, Pa.

WM. W. GOODWIN, Prest. E. STEIN, Sec. S. LEWIS JONES, Asst. Sec. A. J. DOTY, Supt.

The utility and convenience of the Gas Engine being no longer an open question, it only remains now for intending purchasers to select the BEST. We claim for the CLERK GAS ENGINE that it is equal to any other manufactured as regards steadiness in running, simplicity, and ease of keeping in repair, and that it gives the greatest amount of power for the least money (both in first cost and expense of running) of any engine made. In support of this claim we refer to the test of the Gas Engines made under the direction of the American Institute of New York, in December, 1885, and heretofore published in these columns. These engines are especially adapted for continuous running under heavy loads, and we can refer to Engines which have run 22 hours a day for months at a time.

Made in Sizes of 5, 10, 15, 20, and 25 Horse Power. All Engines Guaranteed for One Year.

GAS

AS A SOURCE OF

LIGHT, HEAT, AND POWER.

By C. J. R. HUMPHREYS.

A Pamphlet of twenty-nine pages, treating of the use of Gas as a source of Light, Heat, and Power.

DESIGNED FOR DISTRIBUTION BY GAS COMPANIES AMONG THEIR CUSTOMERS AND OTHERS.

Price, 10 cents each, $5 per 100, $50 per 1,000.

Gas Companies can have their own imprint placed on cover without extra charge. All orders to be sent to

A. M. CALLENDER & CO.,

No. 42 Pine Street, N. Y. Citv.

GOODWIN'S DIRECTORY

OF THE

GAS LIGHT COMPANIES OF THE UNITED STATES & CANADA

Price, ... $10.00.

Orders may be sent to

A. M. CALLENDER & CO., No. 42 Pine Street, N. Y. City.

CONNELLY'S

AUTOMATIC GOVERNOR FOR STREET MAINS.

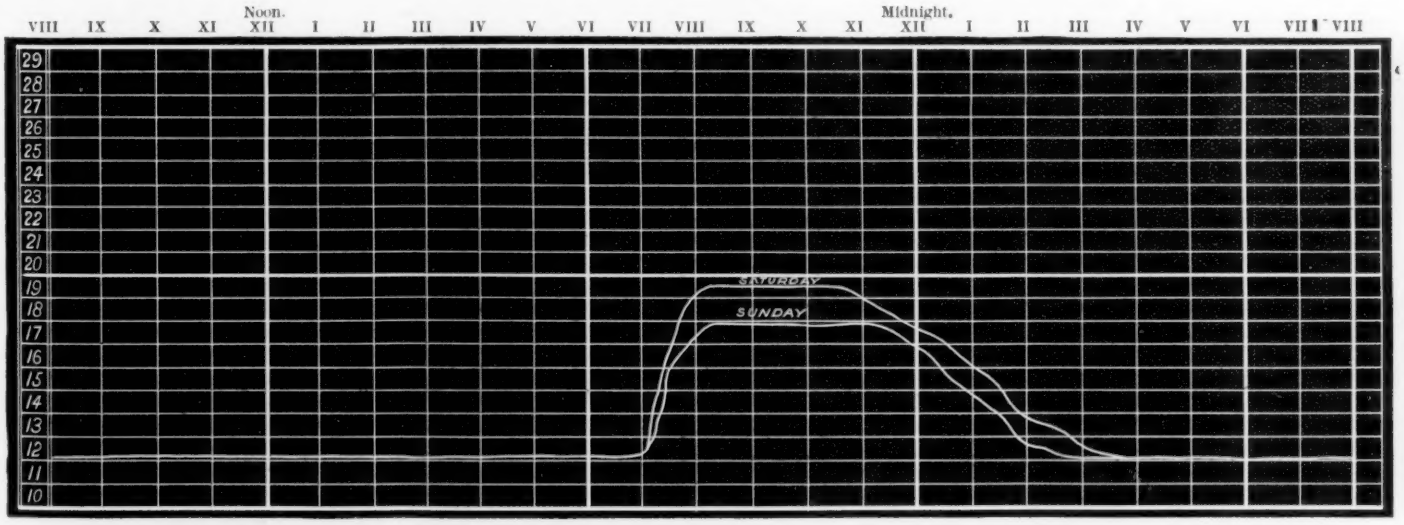
We invite the attention of all practical Gas Managers to the following letter and accompanying cut. The two lines show the pressure held by the Governor on Saturday and Sunday, and clearly illustrates the accuracy of the Governor in *increasing* and *reducing* pressure *in proportion to the volume of gas consumed.*

A Governor that puts the increased pressure on at "one fell swoop" and takes it off in like manner is *not* an "Automatic" Governor; and the circulation of pressure sheets showing such action by a so-called "Automatic" Governor is a rather amusing reflection on the intelligence of Gas Managers.

Strictly speaking, a "Balanced" Governor is an "Automatic" one, as it automatically varies the volume of gas sent out to *maintain a uniform pressure* at its outlet. But, as now applied, the term "Automatic Governor" is understood to mean a Governor that will *maintain pressure between any two desired extremes, in direct proportion to the volume of gas consumed.* Therefore pressure sheets showing *instantaneous changes* from maximum to minimum and *vice versa*, circulated broadcast as the record of an "Automatic (?) Governor," reveals inexcusable ignorance of the subject, amusing to many, yet liable to mislead the inexperienced novice.

We would suggest that all Gas Companies contemplating the placing of *Automatic* Governors would consult their own interests and avoid annoying experience by adopting a Governor *that has a record.*

CONNELLY & CO., LTD., 177 Broadway, N. Y.


Noon.
Midnight.
VIII IX X XI XII I II III IV V VI VII VIII IX X XI XII I II III IV V VI VII VIII
29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10
SATURDAY
SUNDAY

Card Showing Pressure at the Milwaukee Gas Works, Saturday, July 10, and Sunday, July 11, 1886.

MILWAUKEE, WIS., August 3d, 1886.

MESSRS. CONNELLY & CO., LTD., 177 Broadway, New York:

Gentlemen—Replying to yours of 29th, I send you a little package of register sheets. When your Governor (20-inch) was set I adjusted it to give 13-tenths day pressure and 22-tenths night pressure. Saturday nights it would run up to 25-tenths. Whenever it would cloud up in the daytime it would go up at first indication of darkness to about 15-tenths. I hunted back in the sheets to find one when pressure was increased in the daytime, but it is so long since we have had a stormy day I could not find one. You can, however, see a *slight change* on sheets for June 1 and June 25. You will see, too, that lately the Governor only puts on *about* 20-*tenths maximum pressure.* This is because *less gas is burned than when it was adjusted.* We have no complaints of pressure, and everyone appears satisfied. In conclusion, can say the Governor has *never been touched* since it was first adjusted, and has at all times *done just the work we wished it to do.* Very truly yours, E. G. COWDERY, Engr. & Supt.

T. C. HOPPER'S

AUTOMATIC DIFFERENTIAL GAS GOVERNOR

Is now in Practical Operation, doing Perfect Automatic Service with Great Precision.

Others (6, 8, 12 and 16 inch) are now being set; and many more to be shipped soon.

BE SURE TO THOROUGHLY INVESTICATE THE SUPERIOR MERITS OF THIS COVERNOR BEFORE PURCHASING.

For Simplicity and Reliable Work it has no Equal. Correspondence Solicited.

Arch and 22d Streets, Phila., Pa.

MUNICH REGENERATIVE FURNACE

System Drs. Schilling and Bunte.

Greatest Durability! Minimum of Attention!

COMPLETE DISTILLATION IN 3½ HOURS.

Ten to Thirteen Pounds of Coke to Hundredweight of Coal.

NO CLINKER. NO CARBONIC OXIDE IN THE REGENERATIVE FLUES.

Almost Automatic in Action.

The Most Successful Regenerative Furnace in Use.

BARTLETT, HAYWARD & CO

Agents for the United States.

ADAM WEBER'S

New and Improved Regenerative Furnace.

ESPECIALLY ADAPTED FOR USE IN SMALL GAS WORKS.

A Saving of at Least Forty per Cent. over Old Methods.

Cheapness of construction and absence of elaboration are the chief characteristics of this Furnace. It is also applicable in cases where it is not convenient to excavate deeply below the line of the retort house.

Correspondence respectfully solicited. Descriptive Circulars on application.

Manhattan Fire Brick & Enameled Clay Retort Works.

OFFICE, 633 EAST FIFTEENTH STREET, N. Y. CITY.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR UTILIZING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON, Supt., 42 PINE ST., N. Y.

CONNELLY & CO., LTD.

MANUFACTURERS OF

Steam-Jet Exhausters

Requires one-half the flo r space and one-third less steam than any other Exhauster in the market. More cheaply and easily connected, as outside by-pass valves are dispensed with. It is the only Exhauster manufactured having Compensator and Governor combined; the Compensator with all other Exhausters being a separate and distinct machine. It is simple in construction, easily adjusted, not liable to get out of order, and can be operated by ordinary workmen. Over **1,000 now in use.**

No. 177 Broadway, New York.

LUDLOW VALVE MFG. CO.

OFFICE AND WORKS,

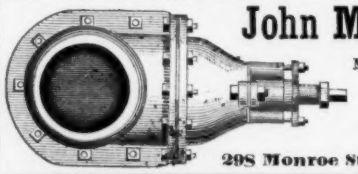
938 to 954 River Street and 67 to 83 Vail Av. TROY, N. Y.

Hydraulic Main Dip Regulators, also Check Valves, Foot Valves, Yard-wash and Fire Hydrants.

Send for Circulars.

Valves.—Double and Single Gate, ½ in. to 48 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, and Oil.

nd for Circulars.



John McLean

Man'facturer of

GAS VALVES.

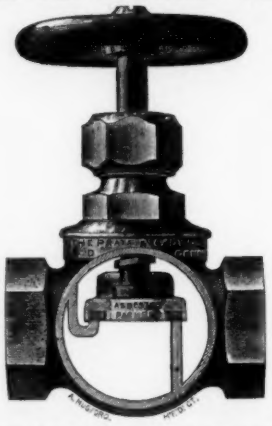
298 Monroe Street, N. Y.

VULCANIZED ASBESTOS

RENEWABLE DISC

GLOBE OR ANGLE VALVE.

Best Gas Valve in the Market.



COCKS THAT NEVER STICK.

Also Straightway Stop and Check Valves with Asbestos Disc and **Asbestos Packed Cocks,** which will keep tight where all other valves fail. We invite inspection and trial by all interested in this line of goods. All goods are warranted to give satisfaction. ☞ Send for Circular and Price List.

FAIRBANKS & CO.,

311 BROADWAY, NEW YORK. 17 LIGHT ST., BALTIMORE, MD.
382 BROADWAY, ALBANY, N.Y. 302 WOOD ST., PITTSBURGH, PA
216 MAIN ST., BUFFALO, N. Y. 715 CHESTNUT ST., PHILA., PA
FAIRBANKS, BROWN & CO., 83 MILK ST., BOSTON, MASS.
AND THE TRADE GENERALLY.

GAS STOVES. GAS STOVES. GAS STOVES.

THE AMERICAN METER CO.,

MANUFACTORIES,

508 to 514 West Twenty-second St., N. Y. **Arch and Twenty-second St., Phila.**

Nos. 244 & 246 North Wells Street, Chicago, Ill.

AGENCIES,

No. 177 Elm Street, Cincinnati, Ohio. Nos. 122 & 124 Sutter Street San Francisco Cal.

No. 810 North Second Street, St. Louis, Mo.

New Design Cast Iron "Economy" Cabinet Stoves.—With Open or Closed Top

THE COMPANY MANUFACTURES

GAS STOVES FOR COOKING AND HEATING PURPOSES,

In all Sizes, for Domestic, Restaurant, and Hotel Use.

Also,

A Variety of Apparatus for Mechanical Purposes, Using Gas as Fuel.

These Stoves may be seen in operation at our Retail Store, No. 223 Sixth Avenue, N. Y. Call and examine.

SEND FOR ILLUSTRATED CATALOGUE SHOWING THE VARIOUS STYLES AND SIZES.

RETORTS AND FIRE BRICK.

J. H. GAUTIER & CO.,
CORNER OF
GREENE AND ESSEX STREETS,
JERSEY CITY, N. J.
MANUFACTURERS OF
Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels,
J. H. GAUTIER. T. B. GAUTIER.
C. E. GREGORY. C. E. GAUTIER.

BROOKLYN
Clay Retort & Fire Brick Works,
(EDWARD D. WHITE & CO.)
Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.
VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.
Office, 88 Van Dyke St., Brooklyn, N. Y.

RETORTS AND FIRE BRICK.

LACLEDE FIRE BRICK MFG. CO.,
MANUFACTURERS OF
Fire Brick, Gas Retorts,
AND
ST. LOUIS STANDARD SEWER PIPE.
Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.
OFFICE AND DEPOT
901, 903, and 905 Pine Street,
ST. LOUIS, MO.

ESTABLISHED IN 1845.
B. KREISCHER & SONS,
OFFICE FOOT OF HOUSTON ST., E.R., N.Y.
Gas Retorts,
TILES, FIRE BRICK.
AND EVERYTHING IN THE FIRE CLAY LINE.

RETORTS AND FIRE BRICK.

MANHATTAN
FIRE BRICK & ENAMELLED CLAY
RETORT WORKS.
ADAM WEBER.
CLAY GAS RETORTS
AND RETORT SETTINGS
FIRE BRICKS, TILES, ETC.,
Office and Works, 15th Street and Avenue C., N. Y.

Works, LOCKPORT STATION, PA.
—ESTABLISHED 1864.—
JAMES GARDNER, JR.,
Successor to WILLIAM GARDNER & SON.
Office, Rooms 19 & 20, Lewis Block, PITTSBURGH, PA, P. O. Box 373.
Fire Clay Goods for Gas Works.
CHAS. H. SPRAGUE & SON, No. 70 KILBY STREET, BOSTON, MASS., Agents for the New England States.

OFFICE, 418 to 422 East 23d St., New York. ESTABLISHED 1856. WORKS, PERTH AMBOY, NEW JERSEY.
HENRY MAURER,
Excelsior Fire Brick & Clay Retort Works
CLAY GAS RETORTS, BENCH SETTINGS, FIRE BRICK, TILES, ETC.

STANDARD GAS RETORT AND FIRE BRICK COMPANY,
J. ANDERSON, Pres. & Mang'r. OF IRONTON, OHIO. C. PETERS, Secretary.
Clay Gas Retorts, Fire Brick, and Fire Clay Goods of Every Description.
Plans of Livesey-Somerville, McIlhenny, and other Furnaces, and Competent Workmen Supplied.

CHICAGO
Retort & Fire Brick Works,
OFFICE AND FACTORY,
Clark, Forty-Fifth, and La Salle Streets,
CHICAGO, ILL.
GEORGE C. HICKS, Pres. PAUL P. AUSTIN, Sec. & Treas.
STANDARD
Clay Retorts and Settings.
BLOCKS & TILES
Of every Shape and Size to Order.
Standard Fire Bricks.

NEWBIGGING'S
Gas Manager's Handbook.
Price, $4.80.
EVERY GAS MAN SHOULD HAVE ONE.
Orders may be sent to this Office.

OAKHILL
GAS RETORT & FIRE BRICK
Works.
Proprietors,
PARKER-RUSSELL MINING & MFG. CO.
City Office, 711 Pine Street,
ST. LOUIS, MO.
Our immense establishment is now employed almost entirely in the manufacture of
MATERIALS FOR GAS COMPANIES.
We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. Our customers are in almost every State of the Union, to all of whom we refer.

Thos. Smith, Prest. August Lambla, Vice-Prest. & Sup
BALTIMORE
RETORT & FIRE BRICK CO.
MANUFACTORY AT
LOCUST POINT, BALTIMORE, MD.
Connection with the City by Telephone.
Clay Retorts, Blocks & Tiles,
FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.
Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 10x10x2.
WALDO BROS., 88 WATER ST., BOSTON, MASS
Sole Agents New England States

RETORTS AND FIRE BRICK. GAS LAMPS. EXHAUSTERS. STEAM PUMPS.

EVENS & HOWARD,

916 Market St., St. Louis. Mo.

Works, Howard Station, Mo. Pacific R.R.

Fire Brick, Gas Retorts

AND

RETORT SETTINGS.

Sewer Pipe, 3 to 24 in. diameter.

Glass Pot Clay, Ground Fire Clay, in barrels and in bulk. All kinds of Fire Clay Goods.

Cincinnati Gas Retort & Fire Brick Works.

—*ESTABLISHED* 1872.—

CHAS. TAYLOR,

MANUFACTURER OF

Gas Retorts, Fire Brick, and Tile.

Blast Furnace Linings, Cupola Blocks, Boiler Tiles, Grate Settings, and Stove Linings. Fire Cement, Fire Clay, Fire Sand, and all other Fire Clay Goods.

Branch Works, New Cumberland, W. Va.

GENERAL OFFICE AND WORKS,

Burns St., Cincinnati, Ohio.

Stettiner Chamotte Fabrik Actien Gesellschaft,

Formerly DIDIER,

(Patentees of the Dr. Schilling & Dr. Bunte Regenerative Furnace)

STETTIN, GERMANY.

The attention of all Gas Engineers is called to our Fire-Proof Material, viz.:

CLAY GAS RETORTS

(ENAMELED AND UNENAMELLED),

Blocks, Tiles

AND

EXTRA FIRE BRICK,

Pronounced by the highest authorities as superior to and excelling any other similar manufacture. The component of aluminum contained in our material (up to 45 per cent.) is larger than in any other material heretofore sold in the United States; whilst the uniformity of the goods is assured by the most scrupulous analysis of the clay used.

For any further information and prices please apply to

EMIL LENZ,

2 & 4 Stone St., Room 19, N.Y. City.

PATENTS.

FRANKLIN H. HOUGH,

Solicitor of American & Foreign Patents

925 F. ST., WASHINGTON, D. C.

(NEAR U. S. PATENT OFFICE.)

Personal attention given to the preparation and prosecution of applications for Letters Patent. All business before the U. S. Patent Office attended to for moderate fees. **No Agency in the United States possesses superior facilities for obtaining Patents,** or for ascertaining the patentability of inventions. Copies of patents furnished for 25 cents each. Correspondence solicited.

G. S. COOK, Pres. THOS. DAVENPORT (late Davenport Bros.), Sec. & Treas

BARTLETT

Street Lamp Mfg. Co.

MANUFACTURERS OF

Bartlett's Patent

GLOBE LAMPS.

FOR

Streets, Parks, Railroad Stations, Public Buildings, Etc.

LAMP POSTS A SPECIALTY.

Office and Salesroom

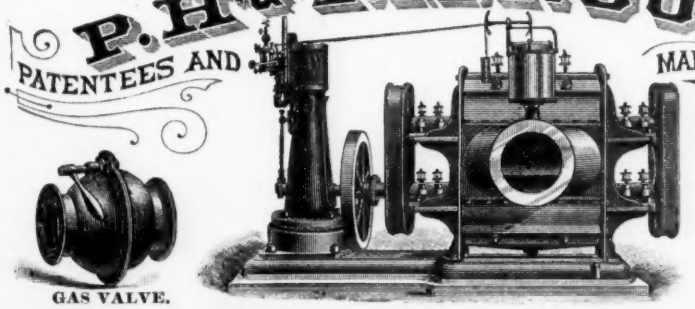
No. 35 Howard Street, N. Y. City.

Gas Companies and others intending to erect lamps and posts will do well to communicate with us.

F. M. ROOTS. S. C. ROOTS D. T. ROOTS.

P. H. & F. M. ROOTS,

PATENTEES AND MANUFACTURERS OF



GAS VALVE. BYE-PASS.

IMPROVED GAS EXHAUSTER,

WITH ENGINE ON SAME BED PLATE, OR WITHOUT.

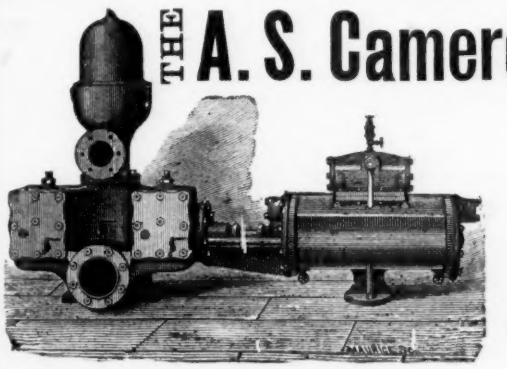
BYE-PASSES, GAS VALVES, GOVERNORS, ELBOWS, PIPE-FITTINGS, Etc., FURNISHED TO ORDER,

P. H. & F. M. ROOTS, Patentees & Manufacturers, **CONNERSVILLE, IND.**

S. S. TOWNSEND, General Agent, 22 Cortland St.

COOKE & CO., Selling Agents, 22 Cortland St., N. Y.

SEND FOR ILLUSTRATED CATALOGUE AND PRICE LIST.



THE A. S. Cameron Steam Pump,

THE STANDARD OF EXCELLENCE.

Upward of 30,000 in Use.

BEST GAS WORKS PUMP

Ever Introduced.

Adapted to Every Possible Duty.

A. S. Cameron Steam Pump Works,

Foot East 23d St., N. Y.

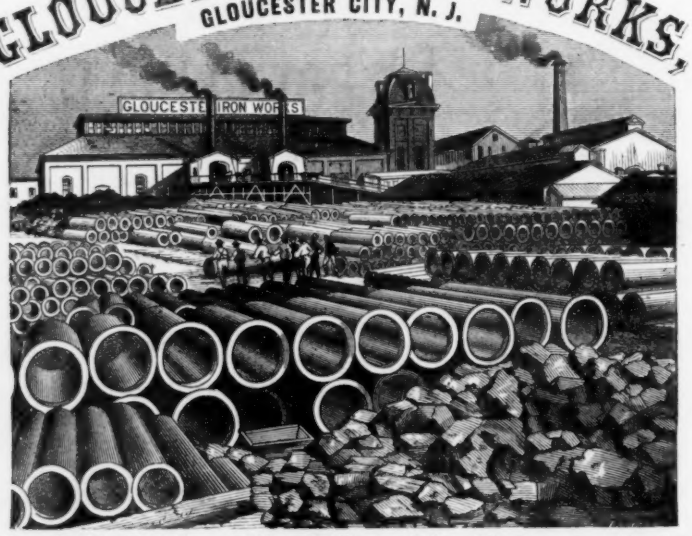
GAS AND WATER PIPES. GAS AND WATER PIPES. ENGINEERS.

SAM'L R. SHIPLEY, Pres.
HENRY B. CHEW, Treas.

JAS. P. MICHELLON, Sec.
WM. SEXTON, Supt.

GLOUCESTER IRON WORKS,

GLOUCESTER CITY, N. J.



Cast Iron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gasholders, &c.

Office No. 6 North Seventh Street, Philadelphia.

ESTABLISHED 1856.

WARREN FOUNDRY AND MACHINE CO.,

WORKS AT PHILLIPSBURGH, N. J.
NEW YORK OFFICE, 162 BROADWAY.

Cast Iron Water and Gas Pipe

FROM TWO TO FORTY-EIGHT INCHES DIAMETER.
ALSO ALL SIZES OF

FLANGE PIPE for Sugar House and Mine Work.

Branches, Bends, Retorts, Etc., Etc. 436-1

MATTHEW ADDY, President. W. L. DAVIS, Selling Agent. GEO. P. WILSHIRE, Sec. & Treas.

Cincinnati and Newport Iron and Pipe Company,

NEWPORT, KY.

Lamp Posts AND **BENCH CASTINGS** A Specialty.

Large & Heavy Castings for General Work.

Branch AND SPECIAL CASTINGS FOR GAS & WATER CO'S.

Manufacture Pipe from 2 to 48 inches. All work guaranteed first quality.

Pancoast & Rogers.

WROUGHT IRON PIPE,

VALVES AND GATES,

Cast Iron Gas & Water Pipe.

28 Platt and 15 Gold St., New York.

The Management of Small Gas Works.

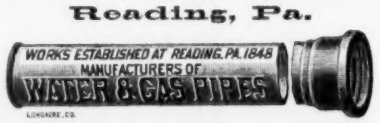
By C. J. R. HUMPHREYS. Price, $1.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

P. D. WANNER, Chairman. A. H. MELLERT, Sec. & Treas.

MELLERT FOUNDRY & MACHINE CO., Ltd.,

Reading, Pa.



Specials—Flange Pipe, Valves and Hydrants, Lamp Posts, Retorts, etc.

General Foundry and Machine Work.

CAST IRON

Gas and Water Pipes,

From 2 to 48 Inches in Diameter.

JOHN FOX,

160 Broadway, N. Y. City.

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS.

Columbus, Ohio.

M. J. DRUMMOND,

SPECIAL CASTINGS AND LAMP POSTS.

95 Liberty St., - New York.

JOS. R. THOMAS, C.E.,

May be Consulted on all Matters Relating to Gas Works and Gas Manufacture.

ADDRESS THIS OFFICE.

WM. FARMER, ENGINEER,

32 Park Place, Room 36, New York.

THE CHEMIST'S ASSISTANT; OR, KINDERGARTEN SYSTEM OF CHEMISTRY.

A system by which the elements and their valences are represented by illustrations and solid bodies.

BOX AND PAMPHLET COMPLETE, $2.50.

WM. HENRY WHITE,

CONSULTING AND CONSTRUCTING

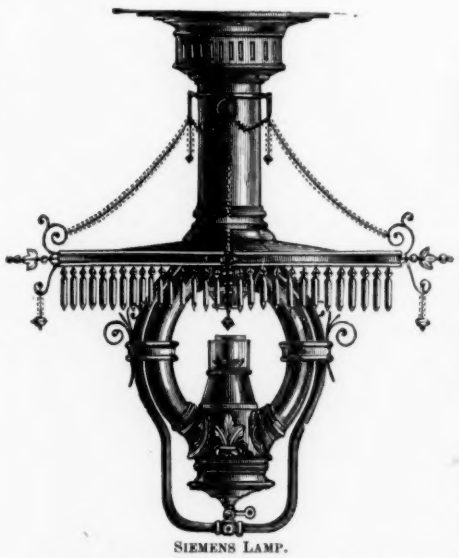
Gas Engineer & Contractor

Estimates, Plans, and Specifications furnished for new wo extensions of existing works.

No. 32 Pine Street, New York City.

Correspondence solicited.

GAS LAMPS. SCRUBBERS AND CONDENSERS.



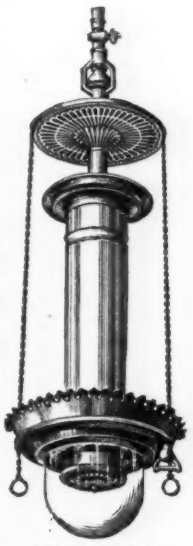
SIEMENS LAMP.

The Siemens and Lungren

REGENERATIVE GAS LAMPS.

A System of Burning Gas whereby its Illuminating Power is Increased fron 300 to 400 per ct. without the Expense, Trouble and Annoyance resulting frow the use of Hydrocarbon Enriching Material.

The Siemens-Lungren Company received the only Silver Medal or Highest Award for Gas Burners at the "Novelties" Exhibition of the Franklin Institute, held at Phila., Oct., '85.



LUNGREN LAMP.

THIRTEEN CANDLE POWER PER CUBIC FOOT OF GAS!

This result is obtained

SIMPLY BY THE SCIENTIFIC APPLICATION OF THE REGENERATIVE PRINCIPLE.

Consequently this largely increased illumination is always maintained without further cost and frequent attention.

THE SIEMENS-LUNGREN COMPANY,

N. E. Cor. 21st. St. and Washington Av., Phila., Pa.

THE "STANDARD" WASHER-SCRUBBER.

The "Standard" Washer-Scrubber has been adopted very generally by Gas Companies in North and South America, Europe, Asia, Australia, and New Zealand.

NO OTHER APPARATUS REMOVES ALL THE AMMONIA FROM THE GAS.

Its dimensions admit of placing it under cover without the great expense incurred in a high building to protect Tower Scrubbers from changes of temperature; thus the "Standard" Washer-Scrubber costs much less than other systems.

J. B. Crockett, Esq., President and Engineer of the San Francisco Gas Light Company, writes, under date of May 22, 1886:

"The 'Standard' Scrubbers have been in constant operation for the past six months, and have given entire satisfaction. We have tried them under many different conditions, and find that, by the use of about two gallons of water per thousand feet of gas, it gives us Liquor of 15 oz. strength. Our coal is from British Columbia, and contains large quantities of Ammonia, and we found it impossible to remove all the Ammonia with one gallon of water; but with two gallons we get good, strong Liquor, and at the same time have no traces of Ammonia at the outlet."

Recent Orders for "Standard" Washer-Scrubbers have been received from

J. P. HARBISON, ESQ., Treas. Hartford City Gas Light Company, and Prest. New England Association of Gas Engineers.
L. N. VAN KEUREN, ESQ., Secretary Bridgeport Gas Light Company - - - - - - - Bridgeport, Conn.
W. H. PEARSON, ESQ., Secretary and General Manager Consumers Gas Light Company, - - - - Toronto, Can.
E. M. BREESE, ESQ., Engineer and Superintendent Detroit Gas Light Company, - - - - - Detroit, Mich.

GEO. SHEPARD PAGE, No. 69 WALL STREET, NEW YORK,

SOLE AGENT FOR THE WESTERN HEMISPHERE.

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

WORKS: { MILLVILLE, N. J. / FLORENCE, " / CAMDEN, "

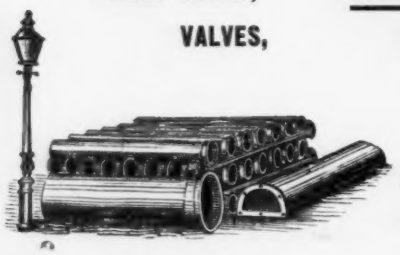
R. D. WOOD & CO.,

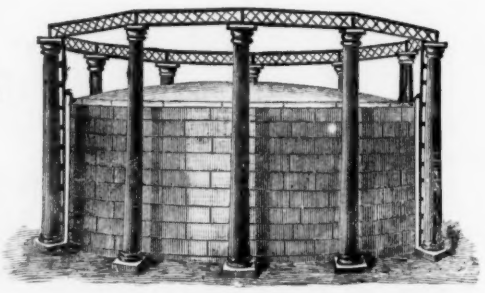
OFFICES: { 400 CHESTNUT ST., / PHILADELPHIA.

CAST-IRON PIPE 1½ to 72 Inches in Diameter.

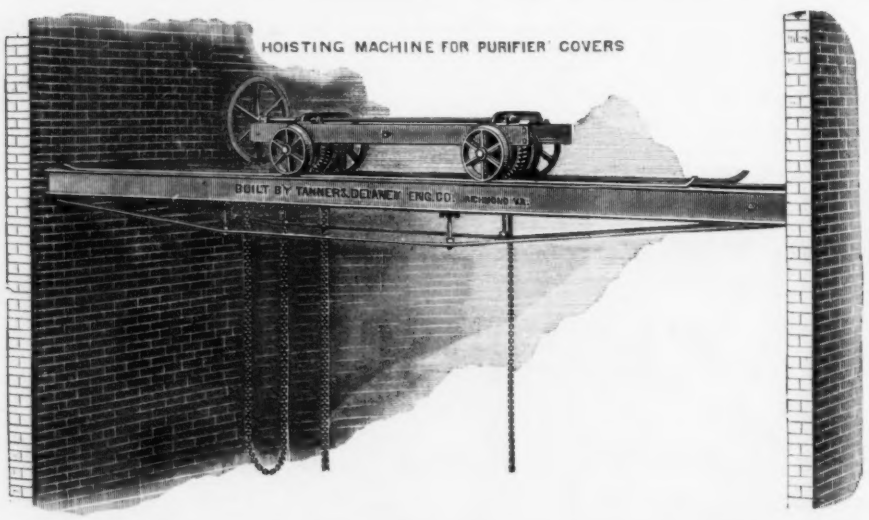
Water Machinery and Gas Apparatus. **HEAVY CASTINGS.**

HOLDERS, PURIFIERS, FLOORS AND ROOFS,
LAMP POSTS, CONDENSERS, FLANGED PIPE,
VALVES, BENCH WORK, FIRE HYDRANTS,
METER CASES.





Estimates and Specifications for NEW WORKS or EXTENSIONS or ALTERATIONS of OLD ONES.



W. E. TANNER, Pres. W. R. TRIGG, Vice-Pres. A. DELANEY, Supt.

Tanner & Delaney Engine Co.,

RICHMOND VA.

GAS APPARATUS,

INCLUDING

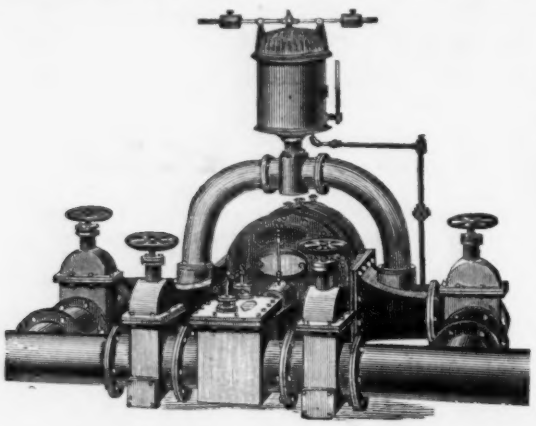
Condensers of Various Styles

SCRUBBERS, PURIFIERS, HOLDERS,

Castings for Retort Houses, Etc.

ALSO STEAM ENGINES AND BOILERS.

Plans, Specifications, and Estimates Furnished.



SMITH & SAYRE MFG. COMPANY,

G. G. PORTER, Prest. *245 Broadway, N. Y.* CHAS. W. ISBELL, Sec'y.

Machinery & Apparatus for Gas Works

Drawings, Plans, and Estimates Furnished for the Improvement, Extension, or Alteration of Gas Works, or for the Construction of New Works.

Mackenzie's Patent Rotary and Steam Jet Gas Exhausters, Governors, Compensators, Condensers, Washers, Scrubbers. Isbell's Patent Automatic Street Pressure Governor, Gas and Water Valves, Hydraulic Main Dip Regulator, Bench Castings, etc. Purifying Boxes and "Standard" Scrubbers. Isbell's Patent Self-Sealing Retort Doors.

SOUTHWARK FOUNDRY AND MACHINE COMPANY,

Successors to MERRICK & SONS,

GAS APPARATUS,

Holders, Purifiers, Washers, Etc., Etc. Boiler and Tank Work. Steam Engines. Hydraulic Machinery. Bessemer Plants, Etc.

Washington Ave. and Fifth Street, Philadelphia, Pa.

MORRIS, TASKER & CO.,

Limited,

Builders of Gas Works,

PHILADELPHIA PA.

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

JAMES R. FLOYD,

(SUCCESSOR TO HERRING & FLOYD)

Oregon Iron Works,

531 to 543 West 20th St., N. Y.

Practical Builders of Gas Works,

MANUFACTURERS OF

ALL KINDS OF CASTINGS AND APPARATUS FOR GAS-WORKS.

BENCH CASTINGS
from benches of one to six Retorts each.
WASHERS: MULTITUBLAR AND AIR CONDENSERS; CONDENSERS; SCRUBBERS
wet and dry), and
EXHAUSTERS
for relieving Retorts from pressure.
BENDS and BRANCHES
all sizes and description.
FLOYD'S PATENT
MALLEABLE RETORT LID.
PATENT
SELF-SEALING RETORT LIDS.
FARMER'S
PATENT BYE-PASS DIP-PIPE.
SABBATON'S PATENT
FURNACE DOOR AND FRAME.
BUTLER'S
COKE SCREENING SHOVELS.

GAS GOVERNORS,
nd everything connected with well regulated Gas Works at ow price, and in complete order.

SELLER'S CEMENT
for stopping leaks in Retorts.

N. B.—**STOP VALVES** from three to thirty inches at very low prices.
Plans, Specifications, and Estimates furnished.

KERR MURRAY MFG. CO.,

MANUFACTURERS OF

Single Lift and Telescopic

GASHOLDERS.

Built, 1884:

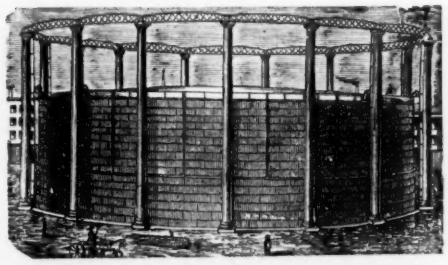
Altoona, Pa	Capacity,	160,000	cubic feet.
Pittsburgh, Pa	"	250,000	"
" "	"	220,000	"
Bellaire, Ohio	"	50,000	"
Youngstown, Ohio	"	60,000	"
Canton, "	"	60.000	"
Akron, "	"	80,000	"
Xenia, "	"	10,000	"
Adrian, Mich	"	65,000	"
Ypsilanti, Mich	"	25,000	"
Muskegon, "	"	70,000	"
South Bend, Ind	"	70,000	"
Anderson, "	"	20,000	"
Plainfield, "	"	10,000	"
Springfield, Illinois	"	100,000	"
Evanston, "	"	50,000	"
Freeport, "	"	35,000	"
Elgin, "	"	60,000	"
Sheboygan Wis	"	20,000	"
Key West Fla	"	10,000	"

Plans and estimates furnished for the erection of new and the rebuilding of old works. Address

Kerr Murray Mfg. Co.,

FORT WAYNE, IND.

CONTINENTAL WORKS.



GASHOLDERS OF ANY MAGNITUDE.

T. F. ROWLAND, Proprietor,
GREENPOINT, BROOKLYN, N. Y.
ENGINEER AND MANUFACTURER OF

GAS-HOLDERS.

CONDENSERS, SCRUBBERS, VALVES, PURIFIERS, RETORTS, and HYDRAULIC MAINS,

and all other articles connected with the Manufacture and Distribution of Gas. Plans and Specifications prepared and Proposals given for the necessary Plant for Lighting Cities, Towns, Mansions, and Manufactories.

H. RANSHAW, Prest. & Mangr. WM. STACEY, Vice-Prest. T. H. BIRCH, Asst. Mangr. R. J. TARVIN, Sec. & Treas.

STACEY MFG. CO.,

MANUFACTURERS OF

Single and Telescopic Gasholders,

IRON ROOFS, BRIDGES, LAMP POSTS,

Water and Oil Tanks, Coal Elevator Cars,

COKE CRUSHERS, BENCH CASTINGS,

And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works.
Rolling Mill Machinery and Heavy Castings a Specialty.

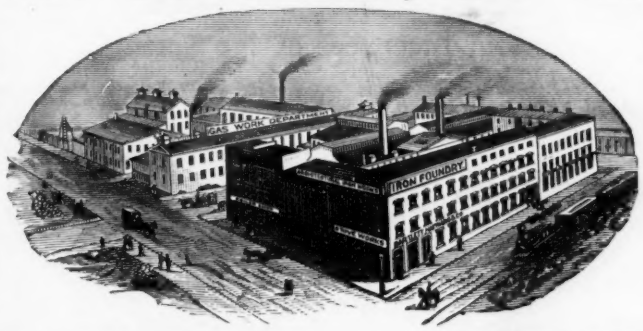
Foundry: 33, 35, 37 & 39 Mill Street. **Wrought Iron Works:** 16, 18, 20, 22, 24 & 26 Ramsey Street.

Cincinnati, Ohio.

BARTLETT, HAYWARD & CO.,

Office, German & Calvert. **BALTIMORE, MD.** Works, Pratt & Scott.

PURIFIERS. Roofs. Bench Castings.



SCRUBBERS. BOILERS. CONDENSERS

GASHOLDERS.

CONSTRUCTING ENGINEERS AND BUILDERS OF GAS WORKS.

1842. DEILY & FOWLER, 1886.

Laurel Iron Works.

Address, No. 39 Laurel Street, Philadelphia, Pa.

MANUFACTURERS OF

GASHOLDERS,

Single or Telescopic, with Cast or Wrought Iron Guide Frames.

Holders Built Since 1881:

Scranton, Pa. (2d)	Hollidaysburg, Pa.	Jackson, Mich.	Montgomery, Ala.	New Castle, Pa.
West Point, N. Y.	Galveston, Texas (2d.)	Kalamazoo, Mich. (3d,)	Newport, R. I.	Long Island City, N. Y.
Fitchburgh, Mass.	Marlboro, Mass.	Glen Island, N. Y.	Portland, Oregon.	Macon, Ga.
New London, Conn.	Denver, Col.	Warren, Ohio.	Allegheny, Pa. (2d.)	York, Pa.
Derby, Conn.	Chicago, Ill. (West Side).	Bath, N. Y.	Atlanta, Ga. (2d.)	Chester, Pa.
Bridgeport, Conn.	Pittsburgh, Pa. (S. Side).	Lynn, Mass.	N.Y.City (Central Gas Co)	Hazleton, Pa. 2d.)
Allegheny, Pa. (1st.)	Pawtucket, R. I.	New Bedford, Mass.	Lynchburg, Va. (2d.)	Novelties Exhib., Phila.
St. Hyacinth, Can.	Brookline, Mass.	Waterbury, Conn.	Saylesville, R. I.	Staten Island, N. Y.
Norwalk, O.	Sherbrooke, Can.	Deseronto, Can.	Rondout, N. Y.	Saugerties, N. Y.
Brattleboro, V	Burlington, N. J. (2d.)	Hoosic Falls, N. Y. (2d.)	Atlantic City, N. J.	Clinton, Mass. (Lan. Mills
Waltham, Mass. (2d.)	Bridgeton, N. J.	Bethlehem, Pa.	Augusta, Ga.	Chattanooga, Tenn.
West Chester, Pa.	Bay City, Mich.	Atlanta, Ga. (1st.)	Waltham, Mass. (2)	Galveston, Texas. (3d,
Baltimore, Md.	Erie, Pa.	Savannah, Ga.	Mahanoy City, Pa.	Omaha, Neb.

GAS COALS. EXHAUSTERS. PROCESSES.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

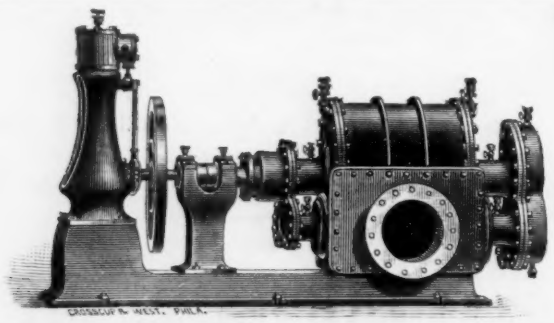
General Sales Agents for

The Youghiogheny River Coal Company's

OCEAN MINE YOUGHIOGHENY GAS COAL.

The Coal from the Ocean Mine (recently operated by Messrs. W. L. Scott & Co., of Erie, Pa.,) is now used by all the leading Gas Companies in the United States from Maine to Texas, and is recognized as *the only reliable Youghiogheny Gas Coal.* (See Map on p. 87 of this Journal, Feb. 16, 1885.)

P. O. Box 3695, New York. **PERKINS & CO., 228 and 229 N. Y. Produce Exchange** BEAVER STREET ENTRANCE.



The Wilbraham Gas Exhauster,

"BAKER SYSTEM,"

WITH ENGINE ATTACHED, ON SAME BED PLATE OR WITHOUT.

Best, Cheapest and Most Durable Exhauster known.

WILBRAHAM BROS.,

No. 2320 Frankford Avenue, Philadelphia, Pa.

NATIONAL GAS LIGHT AND FUEL COMPANY,

Sole Owners and Licensees of the Springer Patent Cupola and Process for the U. S.,

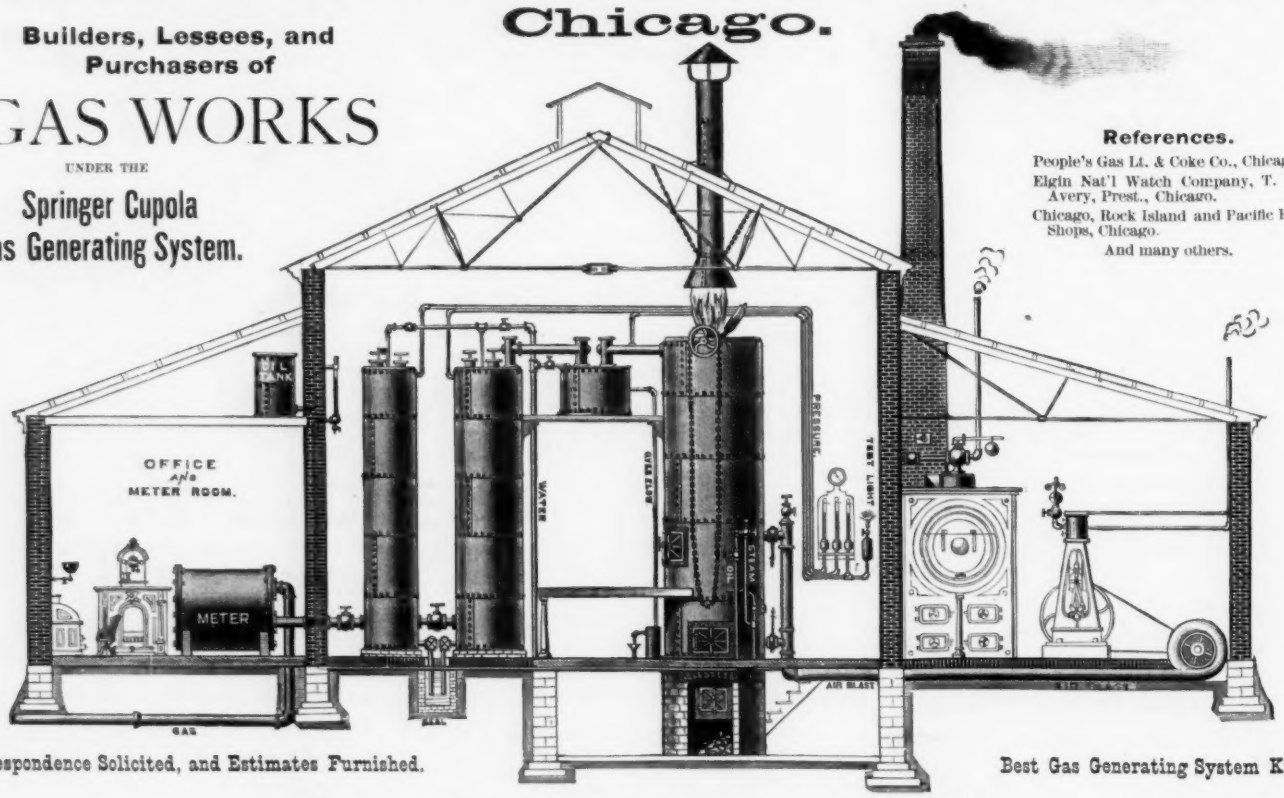
Chicago.

Builders, Lessees, and Purchasers of

GAS WORKS

UNDER THE

Springer Cupola Gas Generating System.



References.

People's Gas Lt. & Coke Co., Chicago.
Elgin Nat'l Watch Company, T. M. Avery, Prest., Chicago.
Chicago, Rock Island and Pacific Ry. Shops, Chicago.
And many others.

Correspondence Solicited, and Estimates Furnished.

Best Gas Generating System Known.

Orders from Cities, Towns, and Public Institutions Promptly Executed. Address

NATIONAL GAS LIGHT AND FUEL COMPANY, - - - - No. 218 La Salle Street, Chicago, Ill.

STEAM ENGINES. GAS COALS. GAS COALS.

Newburgh Orrel Coal Co.,

MINERS AND SHIPPERS OF

Newburgh Orrel, Tyrconnell and Palatine Gas Coals.

ALSO SHIPPERS OF FOUNDRY COKE.

Mines Situated at

Newburgh, Flemington & Fairmont, W.Va.

HOME OFFICE,

25 S. Gay St., Baltimore.

CHARLES MACKALL,

MANAGER.

CHAS. W. HAYS, Agent in New York,

Room 92, WASHINGTON BUILDING, **No. 1 Broadway.**

Shipping wharves at Locust Point. References furnished when required. Special attention given to chartering vessels.

THE DESPARD COAL COMPANY

OFFER THEIR SUPERIOR

DESPARD COAL

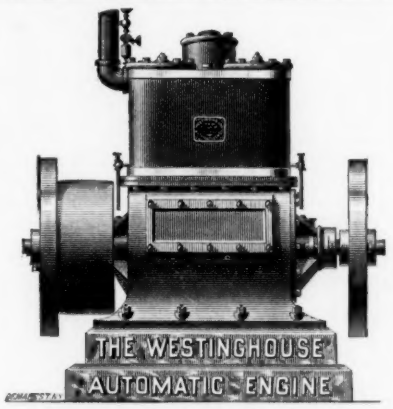
To Gas Light Companies and Manufacturers of Fire Clay Goods Throughout the Country.

ROUSEL & HICKS, 71 Broadway, N. Y. — *AGENTS.* — BANGS & HORTON, 16 Kilby St., Boston.

Mines in Harrison Co., West Va. Wharves, Locust Point, Balt.

Company's Office, 15 German St., Baltimore, Md.

Among the consumers of Despard Coal we name: Manhattan Gas Light Co., N. Y.; Metropolitan Gas Light Co., N. Y.; Jersey City, (N. J.) Gas Light Co.; Washington (D. C.) Gas Light Co.; Portland (Maine) Gas Light Co. Reference to them is requested.



DURING the past year this Company has succeeded, through the medium of special machinery and improved methods, in bringing its output up to 3,500 H.P. per month, while steadily reducing the cost of production. At the same time the materials and workmanship have been greatly improved, as always follows from systematic manufacture. It has become possible, therefore, to carry out a long determined policy, and announce a **SWEEPING**

REDUCTION IN PRICE

OF THE

Westinghouse Automatic Engine,

to which bids already out will be made to conform. All engines have our latest improvements: forged steel rods, oil separators, back pressure balanced valves, etc.

The Westinghouse Engine will be found to be equal or superior in FUEL ECONOMY to any other single valve engine on the market, all the assertions of our competitors to the contrary notwithstanding. We stand ready to make good this statement by public competitive test at any time.

Westinghouse Machine Co.,

PITTSBURCH, PA.

SALES DEPARTMENT CONDUCTED BY

Westinghouse, Church, Kerr & Co.,
17 Cortlandt Street, New York City.
Fairbanks, Morse & Co ..... Chicago, Ill.
Fairbanks & Co ..... St. Louis, Mo.
Parke & Lacy ..... San Francisco, Cal.
Parke, Lacy & Co ..... Salt Lake, Utah.
D. A. Tompkins & Co ..... Charlotte, N. C.
Robert Middleton ..... Mobile, Ala.
H. Dudley Coleman ..... New Orleans, La.
Keating Implement & Machine Co., Dallas, Texas

THE

PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened & Prepared for Gas Purposes.

Their Property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

209 SOUTH THIRD STREET, PHILA., PA.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

Chesapeake & Ohio Railway Coal Agency,

FOR THE SALE OF THE

Superior Kanawha Gas Coals, Cannelton Cannel,

Also, SPLINT AND STEAM COALS.

From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.

C. B. ORCUTT, Sales Agent. | **OFFICE, 150 BROADWAY, N Y.**

FRANCIS H. JACKSON, Prest. EDMUND H. MCCULLOUGH, V.-Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Penn.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

A. M. SCOTT, PRESIDENT. A. DEMPSTER, C.E., SECRETARY. W. K. GILLESPIE, TREASURER.

MONONGAHELA AND PETERS CREEK GAS COAL CO.,

PRODUCERS OF

Coal Bluff Gas Coal.

MINES LOCATED ON THE MONONGAHELA DIVISION OF THE PENNSYLVANIA RR., IN THE CENTRAL PORTION OF THE PITTSBURGH COAL FIELD.

Points of Shipment—Buffalo, Cleveland, Erie, Chicago, New Orleans.

Since the introduction of Coal Bluff Gas Coal it has taken rank among the few first-class Gas Coals, and acknowledges no superior in gas-giving qualities, ease of working, quality of coke, and freedom from impurities.

General Eastern Agents, ANDREW LANGDON & CO., Buffalo, N. Y.
General Western Agents, ANDREW LANGDON & CO., Chicago, Ill.
Milwaukee Agents, F. R. BUELL & CO., - - - Milwaukee, Wis.

General Office, 43 Sixth Ave., Pittsburgh, Pa.

GAS METERS. GAS METERS. GAS METERS.

INTERNATIONAL--1876--EXHIBITION.

The U. S. Centennial Commission

HAVE DECREED AN AWARD TO

HARRIS, GRIFFIN & CO.,

Twelfth and Brown Streets, Philadelphia, Pa. No. 49 Dey Street, N. Y. City, and No. 75 North Clinton Street, Chicago, Ill.,

FOR THE FOLLOWING REASONS:

The Exhibit consists of a Series of METERS from the Largest Size Station Meters for the use of the MANUFACTURE OF GAS, to those for the use of the ORDINARY CONSUMER. The Instruments are WELL MADE, RELIABLE as to INDICATION, and embody a number of sundry improvements which, with the general character of the Exhibit, entitle the whole to commendation.

Attest—J. L. CAMPBELL, Secretary, pro-tem. Signed—A. T. GOSHORN, Director General J. R. HAWLEY, President

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

Maryland Meter and Manufacturing Co.,

DICKEY, TANSLEY & CO.,

Established 1866.

Nos. 22 and 24 Saratoga Street, Baltimore, Md.
No. 46 La Salle St., Chicago, Ill.

MANUFACTURERS OF

DRY GAS METERS, STATION METERS, GLAZED METERS, TEST METERS, METER PROVERS, PRESSURE AND VACUUM REGISTERS, GOVERNORS, INDICATORS, SERVICE AND METER COCKS, AND METER CONNECTIONS.

Dry Gas Meter.

With 39 years' experience and the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

No. 153 Franklin Street, Boston, Mass.,

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges, Pressure and Vacuum Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Patent Cluster Lanterns for Street Illumination.

SCIENTIFIC BOOKS.

We are prepared to furnish to Gas Managers, and others interested in the topics treated of, the following books, at prices named:

KING'S TREATISE ON THE MANUFACTURE OF COAL GAS. Three vols.; $10 per vol.

GAS MANUFACTURE, by WILLIAM RICHARDS. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

THE GAS ANALYST'S MANUAL, by F. W. HARTLEY. $2.50.

TECHNICAL GAS ANALYSIS. $2.80.

GAS MANAGER'S HANDBOOK, by THOS. NEWBIGGING. $4.80.

GAS CONSUMER'S GUIDE. $1.

A GUIDE TO GAS LIGHTING. 40 cents.

GAS MEASUREMENT AND GAS METER TESTING, by F. W. HARTLEY. $1.60

GAS CONSUMER'S HANDBOOK, by WILLIAM RICHARDS, C.E.; 18mo., Sewed. 20 cents.

PURIFICATION OF COAL GAS, by R. P. SPICE. 8vo. $3.

PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

GAS WORKS—THEIR ARRANGEMENT, CONSTRUCTION, PLANT, AND MACHINERY. $8.

COAL; ITS HISTORY AND USE, by PROF. THORPE. $3.50.

THE GAS WORKS OF LONDON, by COLBURN. 60 cents.

THE GAS FITTER'S GUIDE, Showing the Principles and Practice of Lighting with Coal Gas, by JOHN ELDREDGE. 40 cents.

GAS WORKS, AND MANUFACTURING COAL GAS, HUGHES. $2.20.

THE MANAGEMENT OF SMALL GAS WORKS, by C. J. R. HUMPHREYS. $1.

A PRACTICAL TREATISE ON GAS AND VENTILATION with Special Relation to Illuminating, Heating, and Cooking by Gas, by E. E. PERKINS. $1.25.

HOW TO MANAGE GAS, by F. WILKINS. Paper. 20 cents.

THE GAS MANAGER IN THE LABORATORY, by a Practical Student. 8vo., Cloth. $1.50.

THE DOMESTIC USES OF COAL GAS, AS APPLIED TO LIGHTING, by W. SUGG. $1.40.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR, by GEO. LUNGE. $8.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS, by D. A. GRAHAM 8vo., Cloth. $3.

GAS AS A SOURCE OF LIGHT, HEAT, AND POWER, by C. J. R. HUMPHREYS. 10 cents.

GAS COMPANIES DIRECTORY. $10.

GAS VERSUS ELECTRIC LIGHT. 50 cents.

The above will be forwarded by express, upon receipt of price. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check draft, or post office money order.

A. M. CALLENDER & CO., No. 42 Pine Street, New York.

GAS METERS. GAS METERS. GAS METERS.

T. C. HOPPER, Pres. G. J. McGOURKEY, Vice-Pres. (New York). WM. N. MILSTED, Gen. Supt. & Treas. (New York). WM. H. DOWN Sec.

AMERICAN METER COMPANY,

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTRE VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR AND JET PHOTOMETERS.

Manufactories:
512 W. 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES,
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
177 Elm Street, Cincinnati.
244 & 246 N. Wells Street, Chicago.
810 North Second Street, St. Louis.
122 & 124 Sutter St., San Francisco

HELME & McILHENNY,

(Successors to Harris & Brother. Established 1848.)

GAS METER MANUFACTURERS,

CONTINUE AS HERETOFORE AT THE OLD ESTABLISHMENT,

Nos. 1339 to 1349 Cherry Street, Philadelphia, Pa.,

To Manufacture Wet and Dry Gas Meters, Station Meters, Experimental Meters, Meter Provers, Center Seals, Pressure Registers,

COVERNORS, INDICATORS, PHOTOMETERS, & ALL OTHER KINDS OF APPARATUS FOR USE IN GAS WORKS.

From our long practical experience of the business, and from our personal supervision of all work, we car guarantee all orders to be executed promptly, and in every respect satisfactorily.

WM. WALLACE GOODWIN, Prest. and Treas. WM. H. MERRICK, V.-Prest. S. L. JONES, Sec. S. V. MERRICK, Supt.

THE GOODWIN GAS STOVE AND METER COMPANY,

Successors to W. W. GOODWIN & CO.

1012, 1014 and 1016 Filbert St., Phila., Pa. 142 Chambers St., New York.
76 Dearborn St., Chicago, Ill.

WALDO BROS., Agents, 88 Water St., Boston.

MANUFACTURERS OF THE "SUN DIAL" GAS STOVES, FOR COOKING AND HEATING PURPOSES.

Dry and Wet GAS METERS, Station Meters (Square, Cylindrical or in Staves) Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, Etc., Etc., Meter Provers (sizes 2, 5 and 10 feet), Pressure Guages of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4 inch, 6 inch and 9 inch), King's Pressure and Vacuum Gauges, Dry and Wet Centre Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete—also Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

GOODWIN'S IMPROVED LOWE'S JET PHOTOMETER.

Agents for Brav's Patent Gas Burners and Lanterns.

Special attention to repairs of Meters, and all apparatus connected with the business.
All work guaranteed first class in every particular, and orders filled promptly.

G. B. EDWARDS, Mang'r, New York.
E. H. B. TWINING, Mang'r, Chicago.
A. B. STANNARD, Agent.

D. McDONALD & CO.,

GAS METER MANUFACTURERS.

(Established 1854.)

51 Lancaster St., Albany, N. Y. 34 & 36 West Monroe St., Chicago, Ill.

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS, PRESSURE GAUGES, ETC.

Also STAR GAS STOVES, RANGES, and HEATING STOVES.

We use only the very best materials, and employ the most skilled labor, and by our long experience (29 years) and personal supervision of every detail, we feel justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the State Inspector's Badge, and will be fully warranted by us. Our Annual and Calendar will be sent to Gas Companies upon application.

KING'S TREATISE ON COAL GAS.

The most complete work on Coal Gas ever published. Three vols., bound, $30

A. M. CALLENDER & CO., No. 42 Pine Street, New York.

GAS ENGINES. GAS ENGINES. GAS ENGINES.

THE "OTTO" GAS ENGINE.

Guaranteed to Consume 25 to 75 Per Cent. LESS GAS than ANY OTHER GAS ENGINE PER BRAKE HORSE POWER.

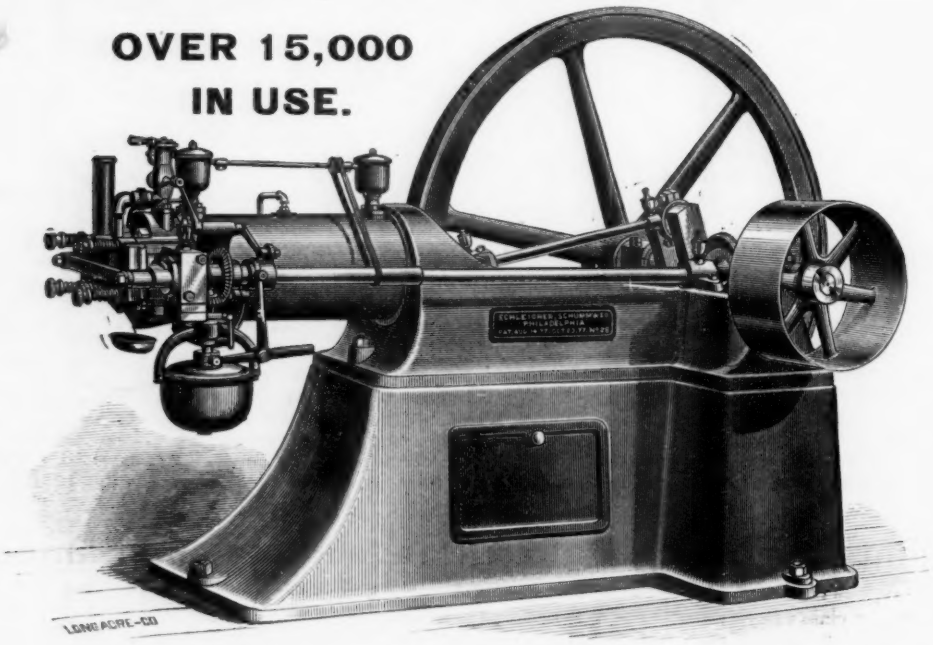
TWIN ENGINES Impulse every revolution.
THE STEADIEST RUNNING GAS ENGINE YET MADE.

ENGINES AND PUMPS COMBINED,

For Hydraulic Elevators, Town Water Supply, or Railway Service.

Special Engines for Electric Light Work.

OVER 15,000 IN USE.



The Otto Gas Engine is now consuming, at a moderate computation, 2000 millions cubic feet of gas per year, nearly all of which is furnished during day time only.

THE ONLY HIGHEST AWARD, ONLY GOLD MEDAL,

AT ELECTRICAL EXHIBITION, PARIS, 1881.

MADE IN SIZES FROM 1 TO 25 HP. INDICATED.

FOR PARTICULARS, PRICES, ETC., APPLY TO

SCHLEICHER, SCHUMM & CO.,

Works:
N E. Cor. 33d & Walnut Sts., Phila., Pa.

Branch Office:
130 Washington Street, Chicago, Ill.